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Roy C. Woodmansee

The Completely Illustrated Course For Developing the Techniques of

MASTER STONESETTING

A Comprehensive Picture/Text Guide on Diamond and Colored Stone Setting

. . . Prongs . . . Beads . . . Bezels . . .

with

Special Emphasis on Pave and Cluster Setting

By Gerald L. Wykoff, G.G.

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To the youngest irrepressibles I know:
Shannon
Dana
Kelly

INTRODUCTION

Of all the techniques and processes involved in jewelry manufacturing, the techniques of diamond and stone setting have probably received the least comprehensive treatment.

To be sure, a number of excellent books, articles, and brochures have been published over the years on various aspects of gemstone setting. For the most part the authors of these written instructions have included setting techniques only as a component of a much larger editorial embrace. This naturally has limited their foc- us to a representative sampling of existing methods and techniques.

The emphasis, too, has been directed toward a rather narrow viewpoint for performing specific stonesetting tasks. By this I mean that the instructions confine themselves almost exclusively to diamond setting. Setting a hard diamond isn't the same as setting the softer, more sensitive colored stones.

At the same time, most of the available literature displays an unfortunate absence of related gemological information—specifications on different gemstones, for example—that any working stonesetter must know and understand.

Stonesetters don't work in a vacuum. Individuals desiring to set a stone—a professional stonesetter, a jeweler, a designer, or a lapidary or diamond cutter—must possess a thorough understanding of various mineral characteristics in order to perform to their fullest potential.

Their gemological education need not be overly extensive, but certainly it should be enough to instill an appreciation that setting a soft opal involves different disciplines than does the setting of the hard diamond. Characteristics other than hardness also come into play so a professional gemsetter must be thoroughly familiar with a number of other properties so as to carry out the best possible setting job each time.

To produce a beautiful piece of jewelry, all elements must be in balance—the design execution, the mounting or fabrication, the gemstones, the setting work. When professionalism has been brought to the fore in each of these areas a fine, saleable demonstration of the jewelry arts is the result.

The "everything in balance" philosophy leads to a famous jeweler's idiom: gemstones produce the profit, but metal work produces the sale.

Call it a shaky cliche if you wish. Before you do, though, keep in mind that even uninformed jewelry buyers can recognize unprofessional metal work far quicker than they can detect shortcomings in the other lapidary arts. They perhaps can't expertly evaluate a gem's cut or quality or analyze the design ambitions of a particular mounting. But they do recognize and appreciate the appeal of superior construction or the vexation caused by an unfinished prong that snags clothing. Poorly executed setting technique appeals to no one.

The skill demonstrated in setting a diamond or colored stone appropriately, securely, and attractively is seen as the ultimate link which binds together the other specialties. Setting ability thus establishes a level of quality and excellence without which the whole concept of jewelry as adornment would be lost.

The ability to take tool in hand and—armed with a solid understanding of gemstones—combine stone and metal into a finished article of jewelry is burnished into the definition of a "jeweler." Webster defines a jeweler as one who "...makes, repairs or deals in jewelry..." The public seemingly views the jeweler as the one who—even absent any demonstrated tool expertise—provides the buyer with the ultimate focal point...the final bringing together of a necessary string of talents and disciplines.

Not all jewelers are adept, or even conversant with diamond or colored stone setting. This can be unfortunate. By developing a modicum—perhaps even a professional level—of setting skills, or at the very least acquiring an understanding of gemstones setting needs and limits, a jeweler is better prepared to serve the buying public. One need not possess technical expertise in order to take advantage of it—or to advise someone what can and can't be done in a particular application.

As with any worthwhile undertaking, developing the physical skills of stonesetting does require a certain amount of practice and dedication. Given many of today's new tools and mountings, an individual can learn to set diamonds and colored stones in an astonishingly short time with professional results. As for mechanical aptitude, usually no special talents are all that critical, and practice has always brought one close to perfection (if one practices the right thing!). Just keep in mind as you work with this book that few of the above demands are so onerous that you should approach the learning process with undue anxiety.

If you're a jeweler, a lapidary, a craftsman, a hobbyist seeking to expand your jewelry skills or perhaps a casual reader with a curiosity about the lapidary arts you'll find that stonesetting is largely a craft of fundamentals. It truly provides an unusual arena for creatively applying physical skills and imagination to any given

task. There's seldom one accepted way of doing a thing: it's whatever works best to attain the final result.

To make learning faster and easier, a sequenced visual approach is presented for the various methods and techniques. The steps used in stonesetting lend themselves nicely to illustrated instructions. Therefore, for the reader's convenience all of the major steps are pictured with keyed captions that offer expanded information and explanation. Deliberately many of the minor steps are repeated. The development of a style or technique is vital to your success and repetition helps instill the fundamentals firmly in mind and action at the outset.

Because stone knowledge is a key ingredient for successful stonesetting, the gemological section is provided first. It's not the intent of this chapter to make you into a gemologist, so the general discussions about crystals and gemcutting are modified to your needs as a setter. Next, recognizing the current dirth of information about specific crystal types, a special reference section has been included. This section lists most commercial stones likely to be encountered by a stonesetter—plus a few of the more esoteric stones favored by collectors—and describes how each variety or species reacts to heat, flame, pressure, acids, liquids, etc.

Heretofore, apprentice stonesetters were required to pick up this gemological information hit or miss—and often by painful experience. It is constantly used information that should be known to every stonesetter as well as those who become involved with any setting function.

Included in the section on stone setting tools you will also find illustrations, descriptions and use instructions for most of the tools employed by stonesetters, including the author's own Pull-Down pliers which have been beta tested by more than a dozen professional stonesetters

The Pull-Down Plier innovation represents little more than a modification on existing utility-type pliers but they make much easier the task of controlling squeezing pressures and vector directions—often a fearsome challenge for beginners—while bending metal over stones. You can quickly and easily modify a pair of small utility pliers and economically determine for yourself just how much easier it is to use these pliers for various metal working applications, including turning down prongs, channels, etc.

It's likely that you will still occasionally come up against a mounting challenge not covered in the chapters on stonesetting techniques. By mastering the principles shown for the many different setting jobs that are covered, though, you should be quite capable of making a slight adjustment or two to solve just about any type mounting or setting you encounter. As you develop skill, you'll understand why

professional stonesetters insist that only three basic types of settings exist—prong, bead, and bezel. Every setting job is a variation of one or more of these basic types.

That's why many stonesetters justifiably contend that creativity is exercised in the manner and selection with which prongs, beads, bezels, etc. are treated and finished. Later, when some steps can't or won't conform to a preconceived setting plan, there will be opportunity to innovate.

Nor will completion of this book signal the end of the learning process. There is always a bit more to be learned about a craft as diversified as stonesetting. The information provided in this book is but the tip of the iceberg...the initial step to a creative, exciting, fulfilling, and potentially profitable journey.

But that's what adventures and journeys are all about...taking the first step. Nothing will ever be accomplished without the beginning burst of commitment— and by reading this far you've already achieved that.

Preface

As a professional jeweler, a practicing stonesetter of some years' experience, and as a teacher of stonesetting, I can attest to the axiom that stonesetting represents the pivotal skill in jewelry making.

For anyone who seeks to learn or to improve their existing skills in setting diamonds or colored stones, this book is the one that will establish a proper course. It short, it has everything—reference information, gemology as it impacts on stone setting, techniques in all phases of the art.

Historically, stonesetters have needed to acquire the mastery of their craft on a hit-or-miss basis...from their own reading or efforts at self-instruction...from experienced craftsmen willing to provide apprenticeships or instructions...from the too-few good, technical institutes or private schools which offer quality, comprehensive training...and, mostly, from incidents at tne bench itself where many lessons seem driven home in memorable yet not always fully understood terms.

I have long felt the need for a better way. Without a required basic level of knowledge, perhaps assisted by continuing education, stonesetting easily can remain a craft of seemingly inpenetrable mystery. More is involved than mere manual dexterity, bending metal over stones. Sculptors don't create fine works of art without a sound knowledge of their tools and of the stone upon which their creative skills are applied. Likewise, a master stonesetting craftsman will emerge only when he or she has developed a full complement of mechanical skills buttressed by an appreciation of various minerals, tools, techniques, metals...in short, a good working knowledge of the jewelry arts and gemology.

I wish this book had been available when I started learning about stonesetting. My progress would have been much easier and swifter. In any event, the book is available now and it can prove helpful to anyone—beginner or experienced—with a serious interest in the craft.

Read this book...learn from it...practice its principles because skill in any craft demands time, patience, and practice. MASTER STONESETTING contains the

techniques of both diamond and colored stone setting while also providing the theoretical elements of the craft.

Not only is this an excellent book from which to learn, but it will also provide invaluable as a constant bench reference.

Apkar (Art) Lefian
Elite Jewelers
Stonesetting Instructor
Cranston, RI

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Other books written by Gerald L. Wykoff, G.G., include:
BEYOND THE GLITTER
MASTER FACETING

CHAPTER ONE

Gemological Essentials

Just when or why men and women decided that the body should be adorned isn't certain. But for untold thousands of years, people have utilized a variety of materials to fulfill their desire for personal decoration.

It's generally believed that animal parts served as the first adornments. More often then not these consisted of the claws and teeth of the vanquished beast, worn no doubt as a testament to the superiority and skill of the hunter over an adversary who was often bigger, faster, and stronger than the hunter.

With time and for a variety of reasons—whether to ward off evil spirits and sickness or to encourage the dieties to look with favor upon the wearer or for religious or symbolic purposes as well as self beautification—other materials were enlisted into use. These included feathers, seeds, berries and dyes, flowers, metals, rocks and crystals. The list could be made as long as human imagination or need which historically has demonstrated an awesome resourcefulness for adapting nearly any material into the realm of jewelry.

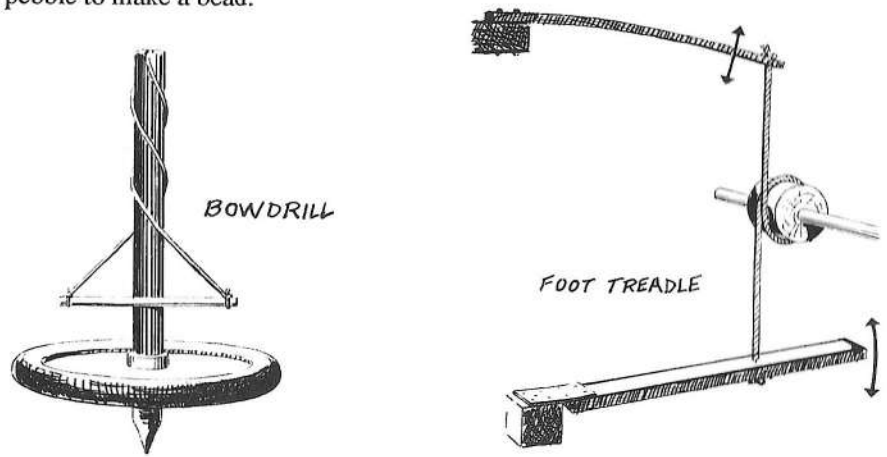
As new materials were introduced, as new levels of design complexity occurred, as increasingly difficult fabrication and assembly problems appeared, men and women responded with amazing ingenuity. They developed new construction techniques, improved the process of enhancing and polishing their materials, invested and built new tools all to meet the challenge of mating different materials in new and interesting ways.

In the beginning perhaps elements were simply lashed together. It most certainly couldn't have taken too long to learn that a sharp piece of flint or rock could be used

to cut a bearing in a chunk of soft bone—a bearing that could entertain a section of cord or string-like material with which the item could be suspended around the neck. Later, a twisting moment could be given to the sharp rock as the process of drilling opened up new vistas for adornment. Without much creative precedence, the primitive caveman may have reasoned that in order to pass a cord through a hole in a lion's tooth, he first needed to perforate the tooth, using maybe a palm-rotated hand drill or bow drill.

His approach wasn't always all that primitive. Truth is, many of these centuries old tools and techniques still form a substantial part of modern jewelry manufacture.

Keep in mind that any well equipped jeweler's bench is equipped with a hand drill—or more probably a high speed power drill. Today's tools may be a bit more refined with steel carbide or diamond abrasive tipped drills replacing flint and chert. The process itself, though, is still just as valid as it was in 15,000 B. C. when the first Neolithic man spent the better part of a day hand twisting his way through a hard pebble to make a bead.



The same observation may be made of most other techniques in jewelry making. They were improvements, yes, but many contemporary advances represent more refinement than they do fundamental change. Truth is, fine jewelry making is still essentially a handmade technology, especially the one-of-a-kind design. The revolutionary impact of modern manufacturing techniques may have made possible fine jewelry for the masses, but the individual artisan working by hand with his own tools and techniques continues as a mainstay. Stonesetting remains a discipline where eye and hand skill are constants, proof that the technical processes for creating most of the jewelry in the world have been with us for centuries.

Yet as much as technology has invaded the craft there remains so much that is fundamentally the same.

Something significant has taken place in jewelry making in the past three decades. The lapidary arts have expanded—perhaps exploded might be a more apt expression—beyond the tight little clique of specialists or artisans-jewelers who have long guarded their trade "secrets" jealously.

Caught up by the fascination and sense of accomplishment that creating a magnificent piece of jewelry offers, more and more so-called newcomers have moved into the jewelry making field. These people include, of course, the independent designers and craftsman working alone at a bench as well as jewelers seeking to expand their talents and appreciation, non-professionals and hobbyists who may work for pay but whose efforts often reflect the human need to realize the deep, meaningful sense of achievement that comes from creative self expression.

Until you have taken a stone and a chunk of metal in hand and fashioned them into something unique, beautiful, rare, and valuable...until you can contemplate in completed form the finalization of your own handiwork...until that time you will probably not know the true appreciation of jewelry—or what is involved in its creation.

Stone setting, if you will, is the junction of the lapidary arts. It is the final element that brings together the other disciplines into a universally desired conclusion—a beautiful reaffirmation of the ever widening limits of jewelry art. Faceting a diamond or a colored gemstone is a rigid undertaking requiring time, talent and attention. The design and fabrication of a mounting or setting is likewise a journey for the talented.

Yet an unmounted gemstone is a museum piece, an exhibition, a magnificent object with but a sense of the potential. Until—. A mounting design, however in- spiring its design and execution, will remain somewhat of a blank canvas awaiting the touch of the master. Until—.

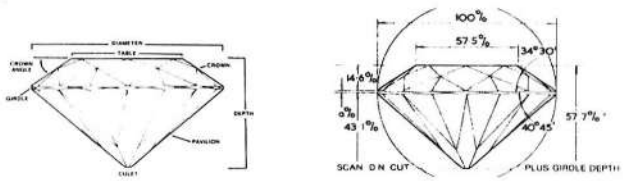
Not until a stone setter merges the stone and the mounting, carefully and creatively molds the components into a unified whole, will the work be done. That's what diamond or colored stone setting is all about—the final, uplifting act of achievement. All else is prelude.

No matter how long or how many times you set beautiful stones into their shimmering mountings it is unlikely that you can avoid the rush of excitement, the ripple of pride at the instant you first view your completed masterpiece. When the finished piece obviously exemplifies your best efforts—when you know you have executed the job well—then you will understand and appreciate craftsmanship and you will never tire of accepting the next challenge.

To produce a truly beautiful jewelry item requires more than just the ability to bend metal over a stone. A series of talents must be artfully blended. The mounting

or setting designer needs to take into consideration the needs of the diamond cutter and/or lapidary as well as the setter to come up with a workable design.

Diamond Proportions: Round Brilliant Cuts



For their part, the cutters or lapidaries must keep in their mind proper dimensions so the finished stone can be attractively—and securely—set into the mounting. But for all its symmetry and color, if the stone's dimensions are inappropriate for a particular setting then either the stone or setting must be excused or altered—and it is often the setter's gemological understanding that will reveal such shortcomings.

To the uninitiated, cabochons and faceted gems are gemological marvels. And they are, too. It takes good hand and eye discipline to fashion a cabochon into one of its many styles or to facet a crystal so that it inspires people with its flat, highly polished faces all laced in harmonious symmetry.

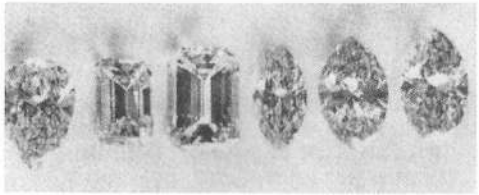
Not only is the geometry of gemstones a marvel to observe but properly cut and mounted gems showcase the richest and purest hues on earth. Small wonder that men and women want them encased in the finest precious metals with which to adorn themselves.

The gemsetter remains the one with final responsibility for the execution of the finished work ie., the ultimate appearance. It will be his or her imagination at work that determines how the prongs are to be shaped and formed, how the stones will be secured into the setting—and what techniques and tools must be brought into play to achieve the finest result.

In making these creative decisions, the setter will need to evaluate a whole host of gemological considerations...shape and design of stones cut, fracturing and cleavage tendencies of stone due to clarity, hardness, toughness, etc., shape and design of setting, ability of stone to withstand heat, flame, acids, abrasives, etc.

In learning the techniques of stonesetting, you are undertaking a craft skill of the highest order, one demanding attention, persistence, and imagination.

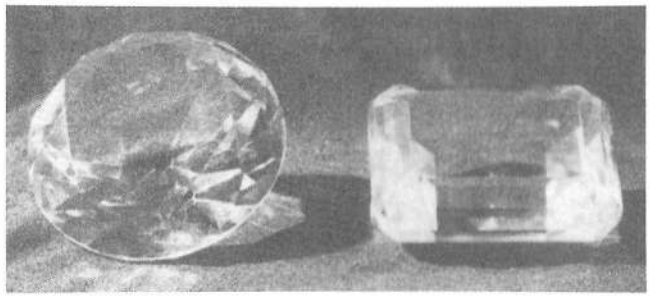
That's why your professional craftsmanship will require a combination of hand-eye skills together with a modest level of gemological understanding. Only when you know, understand and appreciate all of the personality quirks of various gemstone types can you confidently fashion all the parts into the valuable pieces of fine jewelry that the public demands.



Only Two Kinds of Cuts...

Despite all this variety and diversity, the fact still remains: virtually each of the faceted cuts falls into one or the other kind of cutting style. They were either cut in the round brilliant style or in the step cut style—and a gemsetter has a relatively easy response to either style. One quick glance tells you which cutting style you're dealing with and you are ready for the next step. It's actually that easy.

The round brilliant cut of 58-facets exemplifies the brilliant cutting style, while the emerald cut is the most popular example of the step cut style. Step cut styling is characterized by rectangular and/or square facets placed in step fashion, one facet or row of facets atop the previous one(s). Round brilliant cutting, characterized by triangular and/or kite shaped facets, appears more vertical oriented.

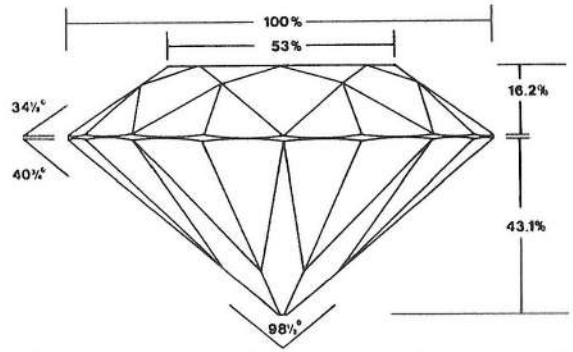


Since round brilliant cutting is intended to bring out a crystal's inherent fire and brilliance it's no surprise that the most brilliant, fiery gems of them all—the diamond—is primarily cut in the round brilliant mode. Generally, whenever you see a stone whose girdle outline is rounded you'll find that the cutter employed brilliant cutting. At the same time, the step or emerald cut is designed to emphasize a crystal's color and whenever you see a design with straight girdle lines and rectangular facets you're probably dealing with a step cut.

An exception, of course, exists for every rule, but essentially the round brilliant cut or one of its modifications—marquise, heart, pear oval—is seen mostly in clear or light colored gems, often with higher values for dispersion and brilliance. Dispersion refers to a gem crystal's ability to break white light up into its numerous component colors (it's the rainbow-like twinkling that you get when you twist or turn a gemstone in the light). Brilliance means the amount of undispersed light that the gem returns to the eye whether internally or externally.

In order to maximize either the dispersed colors or brilliance from a crystal, the faceted round brilliant cut conforms to highly disciplined specifications regarding the angles at which various facets are cut. Engineer Marcel Tolkowsky is credited with establishing the exact proportions for the American or Ideal cut diamond, proportions that mathematically offer the maximum optical performance. Tolkowky's proportions apply only to the diamond, though, because each gem specie varies in its optical, chemical, and physical properties. Consequently, cutting angles and thus stone depths differ somewhat to conform to these variations—but the overall specifications don't change.

Knowing the dimensions that you will encounter with diamonds and colored stones will be most helpful when you must calculate the depth of bearings, how much metal to remove for a gypsy or bezel seat, etc.



As you will note from the drawing, the crown height of an ideally cut diamond is 16.6% of the stone's diameter. Diamond cutters often deviate slightly from this dimension, so an estimate of 20% is valid for a setter's calculations.

If you wish to estimate the height of the crown to help with sizing or cutting a bearing in a prong for a diamond, merely measure the stone's diameter with a millimeter gauge and multiply this measurement by .20 (.20 x Diameter = Crown Height) to get your answer.

What good is this information to a diamond setter?

If you wish to estimate the height of the crown to help with sizing or cutting a bearing in a prong, merely measure the stone's diameter with a millimeter gauge and multiply this measurements by .20 (.20 x Diameter = Crown Height) to get your proabable answer.

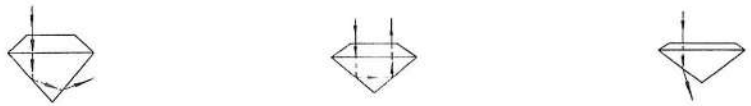
The same procedure works equally well with colored stones except that the multiplier—to compensate for the fact that colored stones are customarily cut with much higher crown angles—is .30. Colored stones usually have much lower optical qualities than do diamonds so the higher crown angles produce a greater depth to diameter ratio ie., they're thicker. A reasonable rule of thumb is: use .20 as the multiplier for all stones with a refractive index of 1.80 or higher, and use .30 for all others.

As a practicing stonesetter, you'll quickly discover that not all diamonds and colored stones are cut to recommended dimensions. For various cutting reasons, the dimensions will vary, and some stones aren't even cut properly. This can be particularly vexing when you want to set, say, a one carat oval into a supposedly one-carat setting and find that, although the pavilion is properly resting on the bridge in accordance with good setting practice, the sharp culet protrudes unacceptably below the base or cage bottom. In the case of a ring, this could expose the wearer's finger to possible gouging by the stone's culet each time the ring is worn.

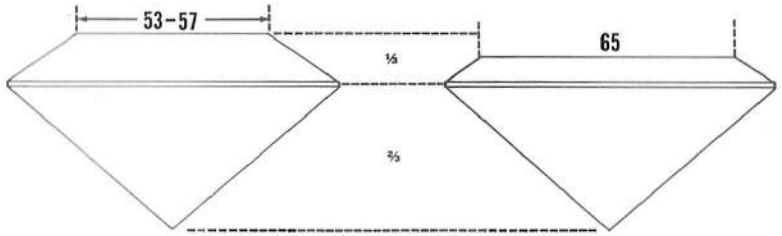
To ward off problems like this, get in the habit of guesstimating the profile of the stone you intend to set. A stone's depth will consist, usually, of 1/3 crown and 2/3 pavilion. Don't get the numbers given in this paragraph confused with earlier percentages cited. The previous numbers were expressed as a percentage of the stone's diameter: the numbers here represent the stone's height percentages.

Most commercial mountings are manufactured to accommodate relatively shallow stones. Any serious deviation—whether with a diamond or with a colored stone—will require either an adjustment in the stone (re-cutting which is seldom acceptable) or a re-working of the setting or prongs (the quickest, easiest and most profitable alternative).

Why do stones vary from recommended proportions? There are a number of answers. A diamond cutter or lapidary strives to attain the highest yield from a piece of rough (yield describes the percentage of finished gem attained from a given amount of rough). With the sometimes extraordinary cost of gemstone rough, a cutter will often sacrifice quality of cut for quantity. Or, when seeking to achieve the finest hue, the cutter knows that an immutable law of optics states that the deeper the stone (and therefore the greater color absorbing distance a light ray must travel

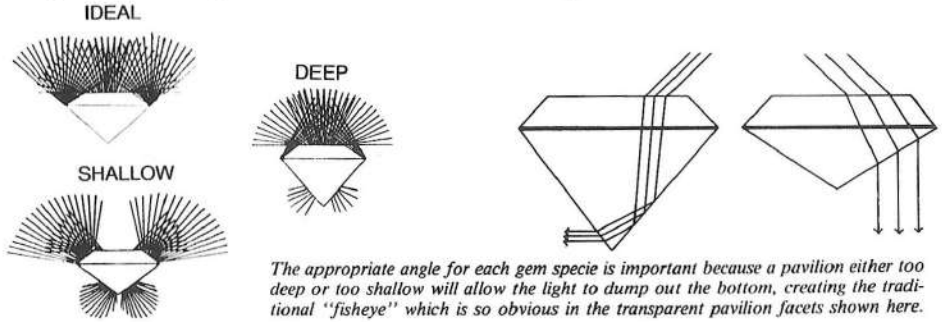


through the medium) the richer the hue. It should therefore come as no surprise that a cutter will quickly add one or more rows of facets to enhance the color—and make the stone deeper and heavier. The consequence to the stonesetter is obvious: the existing cage may not be deep enogh to keep the culet from extending beyond the lower framework limits with the result that the stone must be set higher.



Ignorance of or contempt for optical considerations also play a prominent part when it comes to bastard sized stones. Many foreign cutters, lacking highly calibrated equipment—or simply not aware that angles and optics are so interrelated—place as many facets as possible on the stone consistent with their desire to maximize yield. The result inspires the stonesetter's lament, "...rows and rows of facets tight—yet not a one that's angled right..."

Many of the so-called oriental cuts have multi-rowed pavilions but the pavilion main row—the facet row (sometimes called the culet row) that forms the bottom tip of a faceted gem—isn't cut at the proper angle and the inevitable result is a "fish eye." Study the drawing on this page for a moment so you'll understand what happens to the light in response to the angles on a faceted gem. Note particularly the readiness of the light to leak away when a stone is either too deep or too shallow.



The appropriate angle for each gem specie is important because a pavilion either too deep or too shallow will allow the light to dump out the bottom, creating the traditional "fisheye" which is so obvious in the transparent pavilion facets shown here.

When a cutter deviates too far from acceptable cutting proportions, let's say he

When a cutter deviates too far from accepted cutting proportions, let's say he wants to increase the yield, what you face as a gemsetter is a maximum sized gem—with serious optical problems. Often much of the stone's inherent color is destroyed by light leakage from the bottom of the stone, and its dimensions are not suitable for the flat settings supplied by manufacturers—plus a customer who perhaps expects your setting skills to save the situation by showcasing the gem. Good luck!

The best way to avoid setting problems is to eliminate surprises. That's why you'd be well advised to look over any stone carefully before you begin any setting or metal work. Brilliant and step cutting don't always occur as sharply defined examples. Some cutters want their color and brilliance, too. When this happens you'll run into the interesting area of mixed cuts.

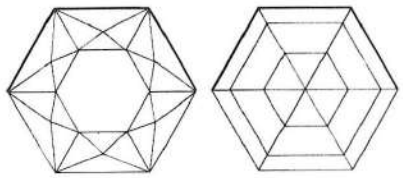
Oriental Cuts Differ in Dimensions...

You can spot an oriental mixed cut this way: the crown or top will be faceted in the brilliant mode, and the pavilion will be faceted with the step cut mode. Such a mixture will often produce a gem with a disproportionately deep pavilion and—often—a thin crown. Make your bearing cuts accordingly.

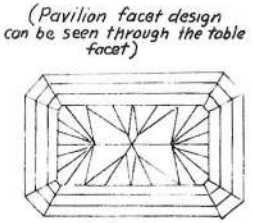
Lately, a new diamond cut has moved into the colored stone business. It's called a Barion, a patented cut originated by a South African diamond cutter named Basil Watermeyer. Watermeyer figured out a stunning technique for mating a slightly altered brilliant pavilion to a step cut crown—the opposite of the oriental mixed cut.

The difference between the oriental mixed cut and the Barion cut is optical excitement.

Many oriental cuts are fish eyed due to improper angles while the disciplined Barion often exceeds the round brilliant in optical performance. Fortunately for the stonesetter, the Barion retains good proportions and usually presents no particular problems as far as setting is concerned.



Mixed Cut



Barion Cut

The drawings explain, too, why seemingly identical stones in identical mountings vary so much in appearance. In these cases, it simply isn't the stone setter: one of the gems is cut improperly in the first place.

The Impact of Color on Gemstones...

A few paragraphs back, mention was made that a gemstone cut at improper angles often fails to live up to its full color potential. All gemstones possess color: even "clear" is a color. But enhancement of a particular gemstone's rich, lush, full hue is first dependent on good cutting, and then must be complemented by good setting.

For this reason, every diamond or colored stone setter should possess a good understanding and appreciation of color.

Only two kinds of gemstones exist—diamonds and colored stones. A diamond of any color is, of course, a diamond, and any other gemstone if it is not a diamond—regardless of its color—is a colored stone. This means that a yellow, red, or blue diamond is not a colored stone: it is a diamond. By the same definition a clear quartz, topaz, beryl, or corundum is a colored stone—the same as bright rubies, sapphires, and emeralds.

To differentiate between clear diamonds—or what some people refer to as "white"—and those diamonds containing color, diamonds with a color involvement which improves the appearance and/or the value of the diamond are called "fancy diamonds."

Notice the phrase "color involvement which improves." Diamonds occur in all colors but four major color ranges predominate. The four color ranges are 1) white-to-yellow; 2) white-to-brown; 3) white-to-green, and 4) white-to-grey (the latter is primarily industrial grade diamond). The percentage of color and its appearance in an otherwise clear diamond is a vital element in establishing value because only a small change in color can represent a rather substantial shift in a diamond's carat value. If the subordinate color merely creates a rather muddy secondary influence, it diminishes the value of the diamond.

Diamonds with a relatively unattractive yellow content (caused by nitrogen in the chemical composition) are called "Capes" or "Yellows" and their price per carat is significantly below a river white diamond. So long as the yellow color appears as a contaminating influence the carat value remains low. But let the secondary color improve until it is the principal

color and you have a "fancy"—the most expensive diamond on a per carat basis.

It's important for you as a stonesetter to be familiar with the color impact which effects the pricing and marketing of diamonds and colored stones. Gemstone setting requires a continuing supply of stones of various types, shapes, sizes, colors and clarities. Even a routine setting job will often obligate you to reach into your own existing inventory of loose, cut stones—particularly for accent stones. Likely as not a major portion of your profit on such jobs will hinge on your ability to buy one or more stones wisely—and to know if the stone(s) you buy is precisely what you want...at the price you should be paying. Color can have an enormous influence on price.

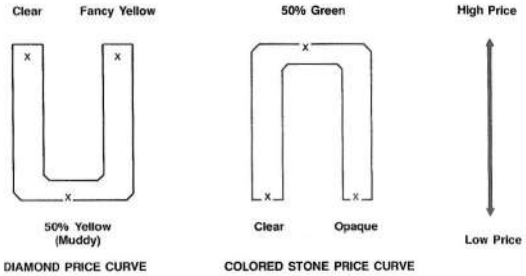
The odd nature of color influence in diamond pricing can be accurately portrayed by thinking of prices as following the shape of the letter "U." At the upper lefthand stem you will find the price location for the colorless, clear diamond—a high price per carat...the kind of "River" or "D" color found in expensive investment grade diamonds. As this clear color is contaminated to a noticeable degree by an unattractive secondary color, the price per carat drops sharply.

Once the secondary color takes on a distinct dominating personality of its own, the diamond enters the realm of "fancy colors"—and the cost per carat, now on the rising stem of the "U," soon outstrips the clear stone price.

The pricing of colored stones follows a pattern opposite to the diamond pricing profile...an upside down "U" or hump. Each colored specie must be rated by itself on the pricing shape which differs a bit from diamond pricing. Colored stones reach their highest value at the 50% level—the top of the hump.

Take emerald as an example: when the clear, cheap mineral beryl becomes contaminated by traces of chromium the result becomes a greenish stone that we call emerald. As the amount of chromium increases the crystal becomes progressively more green until, at about the 50% level, it resembles a rich, lush transparent green gemstone The emerald is at its highest price here. It's value drops precipitously, though, as the green coloration becomes darker, turning the stone opaque.

When it comes time for you to purchase stones keep in mind that the



word "emerald" is pretty much attached to any green colored beryl and this explains why you'll see emeralds offered at prices ranging from $1 per carat to $3,000 per carat. Now it's true that cut, size, and clarity also have a considerable influence on price but color is perhaps the most influential.

Color is particularly important when buying melee and melange—small accent stones used to support or to complement larger stones. Not all gemstone setters are themselves responsible for maintaining a small stone inventory or engaging in the more speculative big stone market, but they should be familiar with the vocabulary and marketing of gemstones.

After all, when a prospective customer asks that accent diamonds for a ruby ring consist of "full-cut diamonds of G-H color, at least VS clarity" it would be helpful if the stonesetter doing the work was tuned in on the same communications wavelength. Indeed, the stonesetter has an even greater responsibility...to be able to advise others on the effect that a mounting or specific accent stone might have on the appearance of a gemstone's color.

A lay person's eyes can detect a color change or color draw in diamonds at about the I-J level. This is a loose diamond under good lighting conditions. As analysis shows, though, the setting can greatly influence the appearance of the diamond. By the same token, a yellow setting can also influence color perception for brightly colored diamonds and colored gemstones. A blue aquamarine appears slightly different in a yellow gold setting than it does in a platinum or rhodium plated white gold mounting.

	COLLECTOR QUALITY			BETTER GEMS		FINE JEWELRY	TYPICAL JEWELRY GRADE						
G.I.A. SCALE	D	E	F	G	H	I	J	K	L	M	N	O-P	Q-R-S-T-U
AGS System	0		1	2	3	4	5	6	7	8		9	
APPEARANCE OF UNMOUNTED STONES	COLORLESS			NEAR COLORLESS				FAINT YELLOW	VERY LIGHT YELLOW				
APPEARANCE OF LARGE MOUNTED STONES	COLORLESS			INCREASINGLY TINTED							YELLOW		
APPEARANCE OF SMALL MOUNTED STONES	COLORLESS						INCREASINGLY TINTED						

In the above chart, note carefully the significant impact upon perceptions that occurs when clear diamonds are either in or out of mountings. Across the top of this chart is a "GIA Scale" with letters running from D thru Z. These are the letter designations of diamonds running the clear-to-yellow color spectrum.

GIA Establishes Vocabulary...

GIA, an acronym for the Gemological Institute of America, is a non-profit gemological educational institution located in Santa Monica, CA. Its principle objective is to upgrade the professionalism of the jewelry industry. One of its more notable achievements has been to promulgate a strict methodology for grading and describing diamonds and colored stones. So successful have been the educational and promotional efforts of GIA over the years, that the GIA diamond grading system is now almost universally recognized as the accepted method. Anywhere in the world now, a diamond can be described using mutually accepted and accurate terms.

Presently, the jewelry industry labors without such a universally accepted language when it comes to colored stones. A number of fine efforts—including a colored stone system by GIA—have been advanced. To date, none has caught the attention or the commitment of the jewelry industry.

Describing Gemstone Colors...

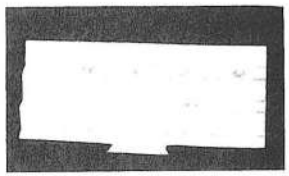
Because so many different jewelry retailers, wholesalers, diamond merchants and others promote their own color grading systems which

rely extensively on the letters A, B, and C, the GIA wisely moved to avoid possible overlap and/or confusion. Thus GIA set up a color grading system beginning with the letter D which was the designation for the highest "clear" color rating, an absolutely white color devoid of any secondary influence.

Each subsequent letter, to the lowest rating of Z, signifies an additional increment of contaminating yellow. This D-to-Z scale does not include fancy yellow diamonds. By definition, all diamonds are evaluated loose, facing a north light at about 5 PM in the northern hemisphere.

Color is a subjective entity, that is no one ever sees the same color twice owing to different lighting conditions, changes in time and position, different orientation, the viewer's own physical and psychological responses. Furthermore, it is unlikely that no two people see precisely the same hue either. To eliminate this unmeasurable subjective element, comparison stones are used. These stones consist of a series of diamonds that have been rated in comparison with GIA's master stones.

Nowadays when a diamond dealer wishes to establish an unequivocable rating he needs only to compare the unrated stone with an already rated comparison stone. Rating a diamond's color is as easy as that.



Colored stones should also be evaluated for color by measuring against a comparison stone. In buying a melee of small rubies, for example, it is easier and more accurate to pull out a speciman ruby of your own, one that possesses the color content you want to make a quick comparison.

To trust your memory by holding up a single ruby and trying to establish an acceptable color rating on the alleged strength of your memory is to court trouble.

The task of evaluating becomes very simple when you slide a comparison ruby up alongside the proffered stone. The best trained human eye will have difficulty on a single stone, but even a layman can detect a color difference in a comparison situation.

For that inevitable occasion when you must evaluate a stone's color, it would be a good idea for you to start collecting colored gem specimen in the 50%-60% color range for use as comparison stones. Comparison diamonds can be a bit expensive in the larger sizes, but small diamonds and colored stones of the color you'll use most in your shop represent a small investment for the kind of color accuracy you'll receive.

Understanding Gemstone Clarity...

In general, gemstone inclusions—and their devaluating ability—revolve primarily around visibility, size, and position...and the specie or variety of stone. Inclusions effect some gem species less than others.

Keep these rules in mind about clarity:

A dark (highly visible) inclusion is more serious than a white inclusion (which can be partially camouflaged by reflections)

A large inclusion is more serious than a small one.

An inclusion visible in the table facet is more serious than any other location.

A dark inclusion located at or very near the culet ("a spot in the heart") is most serious because the bottom facets will pick up and reflect the flaw a number of times.

In evaluating diamonds or colored stones for a clarity rating, only a few rules must be kept in mind. First, inclusions are much more acceptable in colored stones than in diamonds. Second, if you can detect any inclusions only with the aid of a 10x power magnifier you are probably dealing with a stone rating of VS (Very Slight Inclusions—a high commercial rating). Third, if you can see inclusions rather easily with a magnifier and especially if one is located in or near the table facet you are probably dealing with SI (Slightly Included—the average to better commercial grade). Fourth, if you can see inclusions with the unaided eye and, especia-

lly if they are located prominently in the table facet, you are dealing with I (Included—the average to lower commercial grade).

GIA has established ten clarity grades. The table on this page describes each of the grades.

As with color grading, there is no universally accepted clarity system for colored stones although similar terms are used. The principle to remember about colored stone ratings is that inclusions are generally not as serious or objectionable in many colored stones as these same imperfections would be when rating diamonds.

Scandinavia	G.I.A.	A.G.S.*	
flawless	fl	0	No inclusions 10x loupe Clean
internally flawless	I.F.	0+	
VVSI 1	VVS 1	1	Very tiny Inclusions Difficult to see with 10x loupe
VVSI 2	VVS 2	2	
VSI 1	VS 1	3	
VSI 2	VS 2	4	
SI 1	SI 1	5	Small inclusions easily seen w/10x loupe.
SI 2	SI 2	6	
Pique 1	I 1	7	Large, numerous inclusions visible to naked eye
Pique 2			
Pique 3		8	
Pique 4	I 2	9	
Pique 5	I 3	10	
Reject	Reject	11	

*American Gem Society

The broad classifications that colored stone specialists employ are:

F—Flawless
VLI—Very Lightly Included LI—Lightly Included
MI—Moderately Included HI—Heavily Included
VHI—Very Heavily Included

The clarity acceptability range for commercial grade colored stones varies with the stone. Why are colored stones rated against one set of criteria, and diamonds against another more strict set of rules?

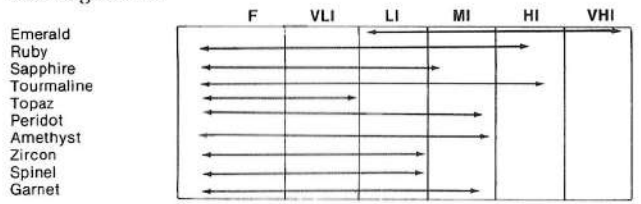
The answer lies in the fact that different elements enter into the grading of colored stones so the task of assigning a value is a bit more controversial ie., subjective.

For instance, a dark color—or even a dark band—can provide very effective covering for inclusions which would be visible in the lighter colored, more transparent gems. Some stones simply aren't found in their natural state free of inclusions. The emerald is a good example of this: it is characteristically so included that gemologists refer to its visible flaws as "jardins"—a French word meaning "gardens." Of all the gemstones you will encounter, you will quickly develop the gemsetter's hesitation about emeralds...they break easily and unpredictably, thanks largely to the inclusions.

Here are the ranges for the most popular colored stones:

F— Flawless
VLI— Very Lightly Included
LI— Lightly Included
MI— Moderately Included
HI— Heavily Included
VHI— Very Heavily Included

The average range for acceptable clarity grading in the better known colored gems are:



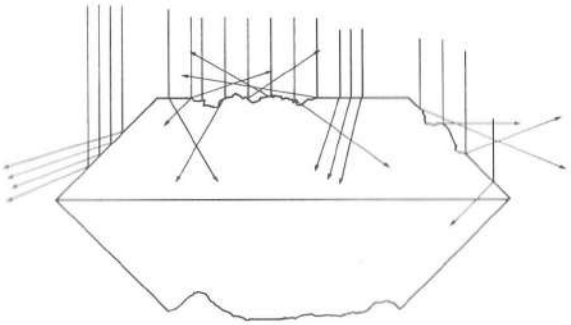
Gemsetters soon become wary when setting any stone with one or more serious flaws, knowing that these imperfections can weaken the structural integrity of the stone. Emeralds are probably the worst offenders with their many flaws, some of which with the slightest pressure or impact will cause the stone to break or chip. Flawed gemstones are potential accidents just awaiting the slightest error in setting judgment.

In the language of gemstone imperfections, you should refer to an internal flaw as an "inclusion." Thus, an inclusion would be a bubble, carbon spot, a liquid filled cavity, a feathered split (that doesn't reach the surface), another crystal buried in the stone, etc.

If the flaw is on the outside of the crystal, it is called a "blemish." A blemish could be a chip, a split or open cleavage showing through the surface, abrasions, scratches, etc. Careless tool use can produce blemishes and a concomitant reduction in a stone's clarity rating. A rubberized abrasive wheel that slips off a prong and touches a colored stone can easily

catch a facet edge and abrade or tear some of the crystal face away. The same can happen with a file whose teeth catch an edge. Be very careful when working on metal near the stone because it takes only a quick slip to abrade an area and destroy a gem's ability to perform.

How can just a slight abrasion wreak so much havoc on a gem's brilliance? A highly polished, flat surface is vital if a gem is to perform at its optical maximum. When facets are properly polished, light rays reflect and refract with rigid optical discipline. In the case of a scratchy, irregular finish, light rays respond helter skelter, thus diminishing optical impact. The difference between parallel deflection and random diffusion of light rays is comparable to the appearance of a smooth, polished metal surface versus a section of corkboard.

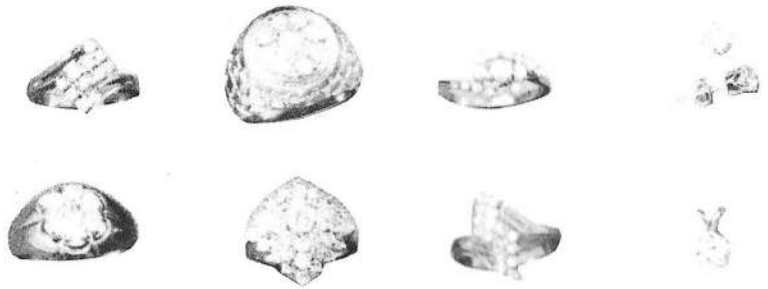


A highly polished, flat surface is vital if a gem is to perform at its optical maximum. When facets are properly polished, light rays reflect and refract with rigid optical discipline. In the case of a scratchy, irregular finish, the light rays respond helter skelter, thus diminishing optical impact.

Knowing that the size, location, and visibility of flaws exert a tremendous impact upon the beauty and value of a faceted gem, the gemcutter and the gemsetter work in unison to diminish the influence of imperfections. The cutter invariably will seek to orient the stone's cut so that any highly visible flaws will be located under the crown facets, as close to the girdle as possible. Here, the natural sparkle and optical activity of smaller facets will help hide the imperfections—and provide an excellent opportunity for the stonesetter to further hide them with metalwork.

Before setting any stone, take a few moments to study the manner in

which the diamond cutter or lapidary has handled any flaws. Can you turn a prong tip over any imperfections and thereby hide them completely? If there are many flaws around the girdle, should you then as an alternative consider a bezel or gypsy type setting? Often, a judicious decision on your part can make the difference between an attractive piece of jewelry and one that customers dutifully return to the jeweler's showcase.



Your responsibility as the stonesetter is to combine the mounting and stone in the most pleasing manner, one that dramatizes the maximum beauty of both while, at the same time, assuring security for the gemstone. It's not an easy task, but armed with an understanding of what the cutter tried to achieve along with an appreciation of what the mounting designer sought you can apply your own skill and imagination into a final, brilliant example of the jeweler's art.

CHAPTER TWO

Gemstone Information

Merely knowing how to bend a prong over a gemstone isn't enough to make someone a professional stonesetter. One needs to have a firm grasp on the characteristics of various gemstone types...which stones can take a considerable amount of pressure...which fracture easily...the impact of acids, polishing abrasives, heat and flame, etc. For the most part, stonesetters only accumulate this knowledge through the experience and guidance of their colleagues or else by steady attendance in the school of hard knocks and broken stones. The former is an excellent, if not always available, source—and the latter is the most expensive, heart breaking route.

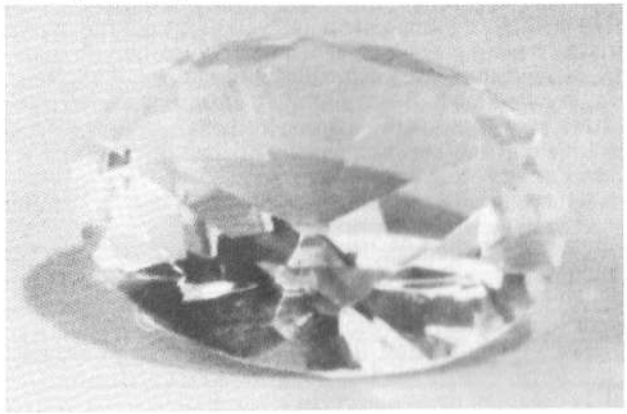
A single reference source has been sorely needed, so—

In this chapter you will find descriptions for virtually all of the different gem species and varieties that you will encounter. A number of the gem types listed here aren't used extensively in commercial jewelry, but there just might be that occasion when a gem fancier wishes to have a beautiful—and delicate—collector's item set in a mounting. It helps to be able to put your finger quickly on appropriate infor- mation about such stones, sometimes before even accepting the job.

Although it isn't necessary for a stonesetter to acquire a gemologist's level of knowledge about gemstones, some recognition of the applicable gemstone characteristics will allow you to work with greater confidence and skill. The touch of a professional lies in his or her ability to understand the elements of a task. The mutually enhancing conjunction of stone and metal is a prime example.

The first rule about gemstones that a setter should observe is: hardness isn't toughness. They're two different qualities.

You are no doubt aware that diamond is the hardest natural substance on earth. This is correct. It is so hard that it will scratch anything—even another diamond. But a diamond is not tough. As a matter of fact, diamond is relatively fragile and can be broken or chipped quite easily.



The 49-carat Pigott diamond—one of the great diamonds in history—was placed on the floor and ground to tiny fragments with one twist of a soldier's boot heel. The dying 80-year-old owner had ordered it destroyed rather than see it fall into someone else's hands.

Jade, on the other hand, is quite soft: you can scratch it easily. Yet its fibrous composition makes it so tough that Chinese artisans have used Jade as an anvil in their workshops for thousands of years. It's tenacity or toughness depends on structural cohesion which defines the way that a mineral is mechanically deformed or distorted. Some minerals are fragile, easily breaking into pieces either by cleaving or by fracturing; other minerals are malleable and, like gold, flatten out into thin sheets without breaking; still others are ductile and can, again like gold, be drawn out into thin threads.

MOHS Table of Hardness...

Toughness is a quality that a stonesetter is concerned with, even more so than hardness. *You will find that almost all gemstones are fragile.* Hardness is the property of resisting abrasion or scratching. This also depends on structural strength but in a much different way than toughness. Hardness is measured by

referring to the Mohs Scale, a hierarchical listing of minerals proposed by German mineralogist Friedrich Mohs in 1822. When a mineral is given a Mohs Scale hardness rating, it means that it can scratch the previous mineral and will be scrat- ched by the one following it.

Study the Mohs scale carefully—and always have a clear understanding of a gemstone's relative position on this scale when you pick up a file, a prong pusher, or some other relatively hard metal tool. When someone tells you that you can with indifference work around the hard diamond with a file or a high speed bur and not worry about damaging the diamond *you are being given extremely bad advice.*

True, the hard steel won't scratch the diamond: that's hardness. But the hard steel can catch a facet edge and cause a ruinous chip or fracture (and this is quite easy to do): that's toughness.

With a good understanding of toughness vs. hardness you'll thus understand why it's safer to use steel tools where any scratching or rubbing movement will be directed against a flat surface. In this manner, the crystal's natural hardness can exert itself. Just remember to stay away from sharply angled facet edges where the slightest impact or snag can abrade or chip because the lack of necessary toughness will work against you.

MOHS SCALE OF HARDNESS

Hardness	Mineral	Description
1.	Talc	(1–2 hardness is defined as very soft and can be scored with a fingernail.)
2.	Gypsum	
3.	Calcite	(2.5–3 hardness is defined as soft and can be scored with a copper wire or coin.)
4.	Fluorite	(3.5–4.5 hardness is defined as semihard and can be scored with a pocketknife.)
5.	Apatite	(5–6.5 hardness is defined as hard and can also be scored with a pocketknife.)
6.	Orthoclase	
7.	Quartz	(7–8 hardness is defined as very hard and cannot be scored with a steel file.)
8.	Topoaz	
9.	Corundum	(9–10 hardness is defined as extremely hard.)
10.	Diamond	(10 Can be scored only by another diamond.)

The level of hardness varies markedly with direction, especially in certain minerals. But this variation isn't sufficiently prevalent to require any special alteration in a stonesetter's approach. Just remember that a flat surface allows you to use hardness to best effect, and a facet edge or any other sharp, thin edge exposes you to the fragility factor—and almost all stones are fragile.

Flame Impact on Minerals...

Although soldering or the use of torches or flame is beyond the scope or intent of this book, some explanation should be offered with respect to the impact of flame on gem crystals. Some gems, such as diamond, can withstand enormous heat and flame (although even a diamond can be scorched if you carelessly permit a hot reducing flame to dwell directly on its surface). Other minerals, such as sulphur, melt quickly and even give off rather unpleasant, irrititating vapors. During heating various phenomena can be observed, depending on the mineral.

By knowing a crystal's chemical composition and comparing it on the Kobell Scale, you can develop a responsive strategy for dealing with any mineral.

In flame testing, a mineral is first measured for fusibility, a somewhat difficult-to-define property which combines not only a mineral's melting point but also its capacity for dispersing or transmitting heat in various directions. Then, a mineral is exposed to increasing flame and compared with the Kobell Scale.

What reactions might you expect if you play a hot torch flame on various gems?

KOBELL SCALE ON FLAME TESTING

1. **Stibnite**	Melts in wax flame (approx 977° F)
2. **Chalcopyrite**	Melts is gas flame (approx 1472° F)
3. **Almandine**	Melts in gas flame, but only in thin slivers (approx 1922°)
4. **Actinolite**	Won't melt in blowpipe, edges become rounded (approx 2192°)
5. **Orthoclase**	In blowpipe, sliver barely becomes rounded (approx 2372°)
6. **Bronzite**	In blowpipe, only finest sliver becomes rounded (approx 2552°)
7. **Quartz**	Not Fusible

The reactions are not totally predictable, but the following samples disclose some general tendencies:

Types	Reaction
Epidote **Scapolite** **Zeolite**	Some minerals in these groups swell and emit bubbles.
Vermiculite **Pyrophyllite**	Some of these minerals tend to shed flakes.
Carbonates **Barites**	Some of these minerals decrepitate, break up.

Stonesetter's Mineral Reference Section

1. Actinolite

Mineral Class: Inosilicate
Chemical: Hydrous calcium magnesium iron silicate

Hardness: 5–6
Acid: Insoluble
Heat: Small pieces fuse easily (4 on Kobell Scale)
Cleavage: Perfect, but not overly sensitive
Toughness: Rather tough
Clarity: Opaque
Color: Dark to light green

Comments: Actinolite is hard and heavy and can take setting pressures quite well. In its fibrous Niphrite (Jade) form it is extremely tough and can easily withstand considerable heat, pressure and chemical exposure. Avoid direct flame on mineral, though; it does scorch.

2. Amazonite (See **Feldspar**)

3. Amber

Mineral Type: Organic
Chemical: Mixture of various resins
Hardness: 2–2.5
Acid: Sensitivity varies but avoid acids
Heat: Burns easily, match will ignite
Toughness: Fairly fragile
Clarity: Transparent to Opaque
Color: Lt. yellow, brown, reddish, blue, milky, green
Cleavage: None

Comments: Seldom faceted, it offers few setting problems despite softness and sensitivity. Can be carved easily with knife. Wipe clean with damp cloth. Avoid ultrasonic or steam.

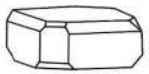
4. Amethyst (See **Quartz**)

5. Andalusite

Mineral Class: Silicate
Chemical: Aluminum Silicate
Hardness: 7.5
Acid: Resistant to acids
Heat: Infusible
Cleavage: perfect, parallel to prism face
Toughness: Tough
Clarity: Translucent to Opaque, rarely transparent
Color: Flesh-red, brown, dark olive green

Comments: Usually cut en cabochon, used mostly as acid resistant, high temperature refractory product. Gives few setting problems, can take heat, acid, pressure. Cleavage not sensitive.

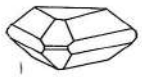
6. Apatite



Mineral Class: Phosphates, arsenates, vanadates
Chemical: Calcium chloro- and fluoro-phosphates
Hardness: 5
Acid: Soluble in acids
Heat: Tends to lose color when heated
Cleavage: Poor, parallel to base
Toughness: Fragile
Clarity: Transparent
Colors: Varies from colorless to yellow, green, brown, red or blue

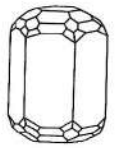
Comments: Easily chipped on edges, girdle, so be very careful about exerting excess pressure when pulling down prongs or bezels.

7. Aquamarine (See **Beryl**)



8. Azurite

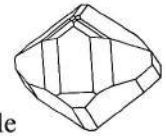
Mineral Class: Carbonate
Chemical: Hydrous copper carbonate
Hardness: 3.5–4
Acid: Highly sensitive
Heat: Fuses Easily
Cleavage: Perfect
Toughness: Fragile
Clarity: Transparent (rare) translucent
Color: Dark blue



Comments: Softness makes it more of a collector's item, even when cut en cabochon or as beautiful blue faceted stone. Excessive heat will turn stone black because of water loss, then mineral fuses. Damaged by ammonia and soluble in even dilute acids. It scratches easily and the cleavage is sensitive to even the slightest pressure. Takes extreme caution to set.

9. Benitoite

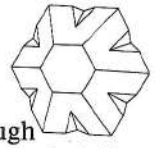
Mineral Class: Cyclosilicate
Chemical: Barium titanium silicate
Hardness: 6–6.5
Acid: Some crystals dulled
Heat: Avoid flame
Cleavage: None
Toughness: Very fragile
Clarity: Transparent to translucent
Color: Dichroic-blue, colorless



Comments: Edges crumble easily. Avoid direct flame which can cause color shift. Acid reaction unpredictable: some crystals dulled by strong solutions, others not affected. Stone can be heated slowly without danger. Don't use in ultrasonic.

10. Beryls

Mineral Class: Cyclosilicate
Chemical: Beryllium aluminum silicate
Hardness: 7.5
Acid: Insoluble
Heat: Difficult to fuse
Toughness: Moderately tough
Clarity: Transparent (often included)
Color: Variable-clear, green, blue



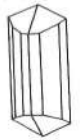
Comments: Setting presents few problems, but watch for inclusions, especially in emeralds, which weaken stone structure. Emeralds are especially prone to break, chip, fracture under pressure because of inclusions, and it's best to avoid mechanical cleaning (ultrasonic, steam). Beryl can take heat but try to avoid direct flame exposure, especially on emeralds which are usually oil treated and on aquamarine which is usually heat treated. Beryl is an extremely popular gem material. Here are the well-known commercial names for different colored beryls:

Emerald—green
Morganite—pink
Goshenite—clear
Aquamarine—blue
Helidor—yellow

11. Brazilianite

Mineral Class: Phosphates, arsenates, vanadates
Chemical: Hydrous sodium aluminum phosphate
Hardness: 5.5
Acid: Dissolves with difficulty in acid
Cleavage: None
Toughness: Fragile
Clarity: Transparent
Color: Yellow, yellow-green

Comments: Because of softness and fragility, this stone appeals mostly to collectors. Rather difficult to set because of readiness to crumble under pressure. Set with care, avoid heat and acids. Check girdle carefully for pre-existing cracks that quickly develop while setting.



12. Carnelian (See **Chalcedony**)

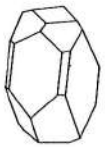
13. Chalcedony (See also **Quartz**)

Mineral Class: Micro-crystalline quartz
Varieties: Carnelian, chrysoprase, heliotrope, agate, onyx, jasper, sardonyx, sard
Hardness: 7
Acid: Insoluble
Heat: Infusible
Cleavage: None but quick conchoidal fracture
Toughness: Fairly tough
Clarity: Transparent to Opaque
Color: Variable color, often treated or dyed

Comments: A distinction is made between Crystal and Micro-Crystalline quartzes. In the crystal quartz family are the transparent gems and those with various optical effects such as cat's eyes, stars, etc. The chalcedony and agate (micro-crystalline) gems include mostly opaque types which are customarily cut en

cabochon or into beads, or are carved. Be wary of onyx. True onyx is a natural layered chalcedony of black and white. "Onyx" (especially when it's enclosed in quotation marks) is a dyed chalcedony—and you should be most careful with flame and bench chemicals lest you ruin the dye job. Sardonyx is a layered chalcedony of brown and white. Carnelian is a peach colored chalcedony, and sard takes on a more brownish hue. All of these minerals are relatively easy to set, and only dyed "onyx" may present a problem. If you suspect a black "onyx" stone, check it carefully under magnification for residual dye pockets, or try dabbing the back (out of a viewer's sight) with a cotton daub soaked with finger nail polish remover. If you get black on the cotton, you're dealing with dye.

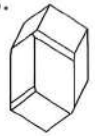
14. Chrysoberyl



Mineral Class: Oxides and hydroxides
Chemical: Beryllium aluminum oxide
Hardness: 8.5
Acid: Insoluble
Heat: Infusible
Cleavage: Yes, but not critical
Toughness: Medium fragile
Clarity: Transparent to translucent
Color: Colorless, green, gray, yellow, brown

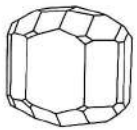
Comments: Highly prized gemstone in any variety, chrysoberyl's hardness and toughness, usually present no problem. Flame is dangerous, though, with Cat's Eye and Alexandrite. Watch for twinning planes (two crystals growing together) which indicates a parting direction sensitive to pressure. The cleavage plane is weak and generally offers no pressure problems.

15. Citrine (See **Quartz**)



16. Coral

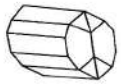
Mineral Class: Organic
Chemical: Calcium carbonate, magnesia, organic
Hardness: 3–4
Acid: Highly sensitive
Heat: Avoid heat, material burns easily
Cleavage: None
Toughness: Fairly fragile
Clarity: Opaque
Color: Black, red, milky (coral is often dyed)



Comments: Easy to trim, cut, and set without too much difficulty. Avoid excessive heat, chemicals, acids. If you're drilling beads, use plenty of water. Since most coral is dyed or color enhanced, alchohol use can be dangerous. Also, avoid

ultrasonic or steam cleaning. If in bead form, check drill holes for previous damage. Glues and epoxies form powerful adhesion between coral and other materials.

17. Cordierite (See **Iolite**)

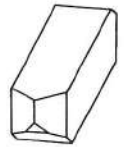


18. Corundum

Mineral Type: Oxides and hydroxides
Chemical: Aluminum oxide
Hardness: 9
Acid: Insoluble
Heat: Infusible
Cleavage: None
Toughness: Tough
Clarity: Transparent to translucent
Color: Variable—clear, red, blue, green, yellow, orange

Comments: Extreme hardness and toughness present few setting problems. Inclusions could weaken stone, so check beforehand. Synthetic corundum that's manufactured by flame fusion process often can't take excessive heat. When it comes to color: a ruby is bright red. Any other color is regarded as a sapphire, including the padparadscha which is orange.

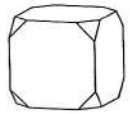
19. Danburite



Mineral Class: Silicates
Chemical: Calcium borosilicate
Hardness: 7–7.5
Acid: Insoluble
Heat: Fuses fairly easy
Cleavage: Poor
Toughness: Fragile
Clarity: Transparent
Color: Clear, sometimes pale yellow

Comments: Gives few setting problems, takes moderate pressure without difficulty. Keep away from flame because it fuses quite easily into a colorless glass.

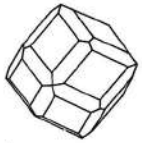
20. Diamond



Mineral Class: Native element
Chemical: Carbon
Hardness: 10
Heat: Burns with difficulty
Cleavage: Perfect
Toughness: Fragile
Color: Multi-colored

Comments: Diamond can take substantial pressure, but chips or abrades easily so be careful when bending prongs over, especially on thin or faceted girdles (sharp fragile edges!). Can take substantial heat but it's advisable to protect diamonds because they can be scorched with direct flame.

21. Dichroite (See **Iolite**)

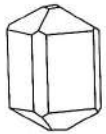


22. Diopside

Mineral Class: Silicates
Chemical: Calcium magnesium silicate
Hardness: 5–6
Acid: Insoluble
Heat: Fuses with difficulty
Cleavage: Perfect
Toughness: Fragile
Clarity: Transparent to translcuent
Color: pale green, blue, whitish, yellowish, brown

Comments: Gives few problems with acid or heat (4 or Kobell scale), but be cautious about applying too much pressure against cleavage plane (87 ° angle between cleavage planes).

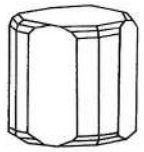
23. Dioptase



Mineral Class: Silicates
Chemical: Hydrous copper silicate
Hardness: 5
Acid: Soluble in acids, also in ammonia
Cleavage: Perfect rhombohedral
Toughness: Fragile
Clarity: Transparent to translcuent
Color: Emerald green
Heat: Easily burned

Comments: You'll usually be dealing with small stones. They can withstand moderate pressure, but watch out for usual sharp edge problems. Flame quickly damages so protect or remove before working with torch. The cleavage takes quite a bit of pressure before it becomes a parting problem.

24. Emerald (See **Beyrl**)



25. Enstatite

Mineral Type: Insosilicate
Chemical: Magnesium silicate
Hardness: 5.5
Acid: Insoluble
Heat: Infusible
Cleavage: Perfect
Toughness: Fairly tough
Clarity: Transparent to opaque
Color: Brown-green, gray

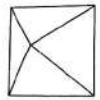
Comments: Often cut for 4-rayed or cat's eye effect. Material coming from India sometimes erroneously called "black star sapphire." Cleavage no serious problem and mineral is tough enough that moderate pressure can be used safely.

26. Epidote

Mineral Class: Silicate
Chemical: Hydrous calcium aluminum iron silicate
Hardness: 6–7
Acid: Insoluble
Heat: Fuses fairly easily
Cleavage: Yes, perfect
Toughness: Fragile
Clarity: Transparent to translcuent
Color: Green, black-brown

Comments: Cleavage is seldom problem, except with heated variety. Tanzanite also chips, fractures easily. Heat is damaging so protect or remove stone (tanzanite is colored by heat process so it's quite sensitive to flame heat).

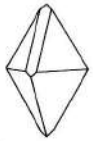
27. Euclase



Mineral Class: Silicate
Chemical: Hydrous beryllium aluminum silicate
Hardness: 7.5
Heat: Fuses with difficulty
Cleavage: Perfect
Toughness: Fragile
Color: Colorless, sea green, light blue

Comments: Be wary of excessive pressure lest you be working against the cleavage plane. Acids and bench liquids offer no problems, and heat is minimal concern although uneven heating can cause cleavage to separate (best to take cooling precaution if using torch). Also, best to avoid ultrasonic or steam cleaning.

28. Feldspar



Mineral Class: Potassium Feldspar—Orthoclase
Calcium Sodium Feldspar—Plagioclase

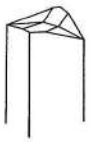
Note: The complex Feldspar Group consists of two main groups: Orthoclase (moonstone, sanidine, amazonite), and Plagioclase (aventurine, labradorite, peristerite, bytownnite, anorthite). For setting purposes, the physical characteristics are close enough that they all can be treated as a group.

Hardness: 6–6.5
Acid: Varies mildly
Heat: Difficult to fuse
Cleavage: Perfect
Toughness: Fragile
Clarity: Transparent, translucent, to Opaque

Comments: Feldspars tend to be extremely sensitive to pressure, and cleavage can offer parting problems. Also, chipping is a factor. Heat and acid vary with the type but generally don't present difficulty. Setting tactics will differ because of diversity of stone varieties, usual cutting style, and different uses. Below is useful information on each variety:

Variety	Clarity	Color	Cutting
Amazonite	opaque	greenish	flat, cabochon
Moonstone	translucent	white	cabochon
Orthoclase	transparent	brownish	faceted
Labradorite	opaque	darkish	cabochon
(Spectrolite—a type of irridescent labradorite found in Finland)			
Aventurine	opaque	orangish	cabochon

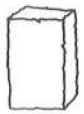
29. Fluorite



Mineral Class: Halides
Chemical: Calcium Fluoride
Hardness: 4
Acid: No reaction
Heat: Decrepitates
Cleavage: Perfect, sensitive
Toughness: Fragile
Clarity: Transparent to translucent
Colors: Colorless, red, blue, violet, orange, yellow

Comments: Cleavage is quite sensitive and stone will part with only minimal pressure. Heat and flame cause severe damage. Edges chip easily. This is a problem stone to set. Because of problems, stone is rarely set for jewelry use.

30. Garnet



Mineral Class: Silicate
Chemical: Varies with species

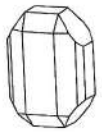
Note: The Garnet Group is another complex, interesting group of gemstones. A number of different garnet types exist but their physical characteristics are sufficiently close for stonesetting purposes that they can be treated as a group.

Type	Color	Chemical
Pyrope	red-brown	magnesium aluminum silicate
Almandine	red-violet	iron aluminum silicate
Spessartite	orange to red-brown	manganese aluminum silicate
Grossular	clear, green yellow, brown	calcium aluminum silcate
Demantoid	emerald green	calcium iron silicate
Uvarovite	emerald green	calcium chromium silicate

Hardness: 6.5–7.5
Acid: Insoluble
Heat: Fuses fairly easy
Cleavage: None
Toughness: Fairly tough
Clarity: Transparent to opaque
Color: Clear, red, orange, green, yellow, brownish

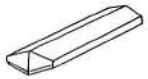
Comments: Garnet is not a difficult mineral to deal with. It can accept pressure although a careless application will cause a splintery type break particularly around thin sharp edges. Reaction to heat is varied but causes enough difficulty that rapid heat change and flame should be avoided.

31. Helidor (See **Beryl**)



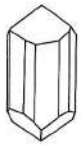
32. Hematite

Mineral Class: Oxides and hydroxides
Chemical: Iron oxide
Hardness: 5.5–6.5
Acid: Resists acids
Heat: Infusible
Cleavage: None
Toughness: Fragile
Clarity: Opaque
Color: Black, red-brown



Comments: The edges are sensitive to pressure, and stone will become magnetic if heated in reducing flame. It takes concentrated hydrofluoric acid to dissolve hematite slowly. The brilliant iridescent polished surface is easily nicked (and the nick really shows) so be careful with tools.

33. Idocrase



Mineral Class: Sorosilicate
Chemical: Magnesium aluminum iron borate
Hardness: 6.5
Acid: Insoluble
Heat: Blisters easily
Cleavage: None
Toughness: Fragile
Clarity: Transparent, translucent
Color: Olive green, yellow-brown

Comments: It fractures conchoidally rather easily under pressure and fuses into a brownish or green glass blister when subjected to flame.

34. Iolite

Mineral Class: Silicate
Chemical: Magnesium aluminum silicate
Hardness: 7–7.5
Acid: Insoluble
Heat: Infusible
Cleavage: None
Toughness: Fairly tough
Clarity: Translucent to transparent
Color: Pleochloric—blue or violet on one axis and straw colored on other

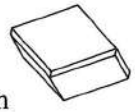
Comments: Iolite is rather easy to set, with few problems. Takes pressure well. Be rather careful around sharp edges because it does occasionally demonstrate a rather unpredictable talent for chipping. It's best to set a jour because the color is usually quite deep.

35. Ivory

Mineral Class: Organic
Chemical: Calcium phosphate
Hardness: 2.5
Acid: Acids will etch
Heat: Burns easily
Cleavage: None
Toughness: Fairly tough
Clarity: Opaque
Color: White

Comments: Ivory can take pressure, but heat and acids can be highly destructive. Remove from setting when using torch since even hot prongs will scorch ivory. Don't place in ultrasonic cleaner or use steam.

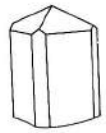
36. Jade



Mineral Class: Silicate
Chemicals: **Jadeite**—sodium aluminum silicate
Nephrite—calcium magnesium iron silicate
Hardness: 6.5–7
Acid: Insoluble
Heat: **Jadeite** fuses rather easily—**Nephrite** can take heat well
Cleavage: None
Toughness: Very tough
Clarity: Translucent to opaque
Color: **Jadeite**—white, green, yellow, lavender, mauve, black
Nephrite—green, often with dark spots

Comments: Jadeite is generally the more delicately colored of the two species—and the more expensive. For the most part, Nephrite is an apple green, often with black spots. Neither offer setting problems although Jadeite is more sensitive to heat, flame: under flame it will fuse to a near transparent globule. Nephrite is the tougher of the two and in block form is useful as a bench anvil. The considerable toughness of the minerals is due to their fibrous personalities, a quality that makes setting quite easy although Jadeite can rather easily be chipped if the setter is careless.

37. Jadeite (See **Jade**)

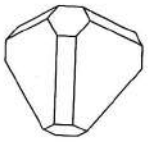


38. Jasper (See **Chalcedony**)

39. Kyanite

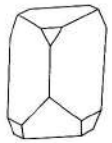
Mineral Class: Silicate
Chemical: Aluminum silicate
Hardness: 6–7 or 4–5
Acid: Insoluble
Heat: Infusible
Cleavage: Yes, but parts with difficulty
Toughness: Fragile
Clarity: Transparent to translucent
Color: Light blue

Comments: Kyanite, used only occasionally as a gem, finds greatest use in manufacturing high temperature porcelain products. It takes heat very well and is practically impervious to acids. Its hardness varies from 6–7 across the cleavage plane to a semi-hard 4–5 along the cleavage plane. Be careful when applying pressure because most faceters orient cleavage plane a few degrees away from the table facet plane.



40. Labradorite (See **Feldspar**)

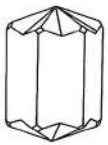
41. Lapis Lazuli



Mineral Class: Tectosilicate
Chemical: Sulphur, sodium aluminum silicate
Hardness: 5–6
Acid: Very sensitive
Heat: Fuses easily
Cleavage: None
Toughness: Very fragile
Clarity: Opaque
Color: deep blue with pyrite inclusions

Comments: Set en cabochon mostly, also beads. Lapis is very sensitive to pressure, high temperature, acids and alkalies. Be wary, too, around chemicals because much lapis is often dyed and/or color enhanced.

42. Lazulite



Mineral Class: Phosphate
Chemical: Magnesium iron aluminum
Hardness: 5–6
Acid: Resists acid
Heat: Decrepitates
Cleavage: Perfect, but sensitive
Toughness: Fragile
Clarity: Opaque, transparent (rare)
Color: dark blue, blue-white

Comments: The cleavage is indistinct and resists pressure rather well. When subjected to heat, lazulite will discolor then decrepitate ie., break into tiny

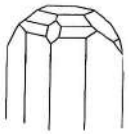
fragments. Quite rare in transparent form, it is usually cut en cabochon or as an ornamental stone.

43. Malachite

Mineral Class: Nitrates, carbonates, borates
Chemical: Hydrous copper carbonate
Hardness: 3.5–4
Acid: Soluble
Heat: Loses water, turns black
Cleavage: None
Toughness: Fragile
Clarity: Opaque
Color: Dark green with light green streaks, swirls

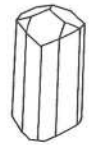
Comments: Soft, fragile mineral crumbles easily if excessive pressure is applied. Be careful to avoid roughing up surface because malachite easily loses polish. . . loses it anyway over time. Often bezel set. Check bead holes carefully: they often have edge damage from careless drilling or use. Keep out of ultrasonic cleaner or pickling solutions.

44. Moonstone (See **Feldspar**)



45. Morganite (See **Beryl**)

46. Nephrite (See **Jade**)

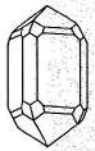


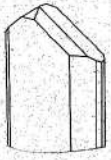
47. Obsidian

Mineral Class: Igneous rock
Chemical: Varies, but usually felsic
Hardness: 5
Acid: Sensitive to hydrofluoric
Heat: Exterior turns
Cleavage: None
Toughness: Very fragile
Clarity: Translucent to transparent
Color: Brownish-black, often with whitish, (snowflakes) spots

Comments: Obsidian is an amorphous volcanic glass and is usually cut en cabochon, sometimes faceted for its golden or silvery sheen caused by inclusions. In setting, treat like glass: be careful because it fractures readily, especially on sharp, weak edges. Many stonesetters actually cut a flat

notch on prongs to accommodate the girdle and minimize pressure when the prong is bent over.





48. Onyx (See **Chalcedony**)

49. Opal

Mineral Class: Tectosilicate
Chemical: Hydrous silicon oxide
Hardness: 5.5–6.5
Acid: Sensitive to HF acid and to strong alkali sols.
Heat: Decomposes
Cleavage: None
Toughness: Extremely fragile
Clarity: Opaque, translucent and transparent
Color: Colorless, milky, blue or gray with opalescence

Comments: For setting, opal is a beautiful problem child. It fractures under the slightest pressure; is sensitive to acids and alkali solutions, will decompose quickly if heated excessively by flame. Take extra precautions that metal does not exert undue pressure anywhere and proceed slowly. Particular attention should be given to the girdle bearing on prongs to allow non-pressure safety allowance. Don't steam clean or use ultrasonic.

50. Orthoclase (See **Feldspar**)

51. Padparadscha (See **Corundum**) ~ Orange

52. Pearl

Mineral Class: Organic
Chemical: Calcium carbonate
Hardness: 2–2.5
Acid: Varies, but damage is certain
Heat: Can be ignited easily
Cleavage: None, it's scaly
Toughness: Brittle, fragile
Clarity: Opaque
Color: White, green, blue, black, golden, pink, silver, cream

Comments: Pearl is delicate and will scale upon undue pressure. Heat or flame is destructive — but some setters wrap pearl in wet tissue or cloth and apply flame to setting with no damage (keep the pearl wet and cool, though). Pearls spot even from water so keep out of acid, Saprex, pickling

solution. Don't steam clean or use ultrasonic. A gentle shampoo or mild soap — with lukewarm water — are the safest liquid cleaning agents but be sure to wipe away as soon as possible.

53. Peridot

Mineral Class: Silicate
Chemical: Zinc silicate
Hardness: 6.5–7
Acid: Sensitive to hydrochloric, cold concentrated citric
Cleavage: None
Toughness: Fragile
Clarity: Transparent
Color: Light green
Heat: Not heat critical

Comments: Peridot should be treated like glass for setting purposes. It fractures easily when prongs are turned over sharp edges. Be cautious about dipping a peridot into Sparex or other bench chemicals: they sometimes create pits in the gem's surface. Generally flame will not cause problem but Peridot is unpredictable so it's best to use caution.

54. Petalite

Mineral Type: Tectosilicate
Chemical: Lithium aluminum silicate
Hardness: 6–6.5
Acid: Insoluble
Heat: Not heat sensitive
Cleavage: Yes
Toughness: Fragile
Clarity: Transparent to translucent
Color: Colorless

Comments: Petalite is quite rare and its fragility requires pressure caution. The cleavage plane is not overly sensitive and shouldn't give too much difficulty if moderate pressure is maintained during setting. It's extreme brittleness gives setting problems on the edges, so be careful.

55. Phenacite

Mineral Class: Nesosilicate
Chemical: Beryllium silicate
Hardness: 7.5–8
Acid: Insoluble
Heat: Infusible, takes heat
Cleavage: Imperfect, no problem
Toughness: Fairly strong
Clarity: Transparent
Color: Colorless

Comments: Presents few problems for the setter. It's a tough, durable gem crystal. Heat or acids offer no difficulty.

56. Prehnite

Mineral Class: Phyllosilicate
Chemical: Calcium aluminum silicate
Hardness: 6–6.5
Acid: Relatively resistant
Heat: Blisters easily
Cleavage: Perfect basal
Toughness: Fairly tough
Clarity: Transparent
Color: Yellow with green or brown

Comments: Crystals are quite rare, and their heat sensitivity and cleavage require care in setting. Occasionally, a cat's eye prehnite is seen, but all crystals fall into the collector's area.

57. Quartz

Mineral Class: Tectosilicate
Chemical: Silicon oxide
Hardness: 7
Acid: Insoluble
Heat: Infusible
Cleavage: None
Toughness: Fairly fragile
Clarity: Translucent to transparent
Color: Colorless when pure

Comments: Microcrystalline quartz includes many of the well-known faceted varieties, whose different colors are due to chemical contaminants. All of the gem types given here can be handled pretty much alike:

Name	Color	Usual Gem Cut	Often Named
Rock Crystal	clear	faceted	———
Smoky quartz	brown	faceted	Smoky Topaz
Blue quartz	blue	faceted	(often synthetic)
Pink quartz	pink	faceted, cabochon	rose de'France
Citrine*	yellow or brown	faceted, cabochon	Citrine Topaz
Amethyst**	violet	faceted, cabochon	

*If you see reddish cast in color, it's a heat treated citrine
**Will lose color if subjected to excess flame heat

Two other gem types within the microcrystallines are 1) tiger's eye, a brown stone containing fibers of crocidolite, and 2) aventurine quartz, a spangled green or brownish-yellow appearing stone. Both types are non-sensitive to acids and can take pressure and heat reasonably well.

58. Rhodochrosite

Mineral Type: Nitrates, carbonates, borates
Chemical: Manganese carbonate
Hardness: 3.5–4.5
Acid: Soluble in acid
Heat: Flame blackens
Cleavage: Yes, sensitive
Toughness: Very fragile
Clarity: Opaque, transparent (rare)
Color: Pink, banded

Comments: You'll rarely encounter a faceted, transparent rhodochrosite but if you do, exercise extreme care because it is extremely fragile and the cleavage separates without too much pressure. Mostly you'll see white banded pink material which finds extensive use for carvings and cabochons.

59. Rhodonite

Mineral Type: Inosilicate
Chemical: Manganese iron magnesium silicate
Hardness: 5.5–6
Acid: Insoluble
Heat: Avoid direct flame
Cleavage: Yes, moderately sensitive
Toughness: Fragile
Clarity: Transparent to translucent
Color: deep pink

Comments: Similar in appearance to rhodochrosite except for its black dendritic inclusions, rhodonite is mostly cut en cabochon as well as into beads. Because of its softness, it presents edge crumbling problems when subjected to excessive pressure.

60. Ruby (See **Corundum**)

61. Sapphire (See **Corundum**)

62. Saud (See **Chalcedony**)

63. Sardonyx (See **Chaledony**)

64. Scapolite

Mineral Type: Tectosilicate
Chemical: Complicated sodium calcium aluminum silicate
Hardness: 5–6.5
Acid: Reacts slowly to acid
Heat: Avoid direct flame, it fuses easily
Cleavage: Yes, but not sensitive
Toughness: Fragile
Clarity: Translucent to transparent
Color: Yellow, pink, violet, colorless

Comments: More of a collector's stone, it is rarely set in jewelry. Edge crumbling and sensitivity to flame cause most of the difficulty. The two cleavage planes part with difficulty. Should be kept out of ultrasonic and away from steam cleaning.

65. Scheelite

Mineral Type: Sulfates, chromates, molybdates
Chemical: Calcium tungstate
Hardness: 5.4–5
Acid: Acid sensitive
Heat: Not heat sensitive
Cleavage: Yes, moderate
Toughness: Fragile
Clarity: Translucent to transparent
Color: Yellow, green, gray

Comments: The cleavage plane can withstand moderate pressure before parting but the softness and fragility demand a soft touch. It's seldom set in jewelry.

66. Sphalerite

Mineral Type: Sulfides
Chemical: Zinc iron sulfide
Hardness: 3.5–4
Acid: Sensitive to HCL
Heat: Infusible
Cleavage: Perfect, several
Toughness: Extremely fragile
Clarity: Transparent to translucent
Color: Yellow, green, brown

Comments: Sphalerite is a soft, cleavable stone that presents problems to cutters and setters alike. It rivals the diamond for optical excellence but is seldom faceted or mounted because of its softness. It has several sensitive

cleavage planes and crumbles at the least pressure. It's sensitivity to heat increases because of the iron content in the chemical composition.

67. Sphene

Mineral Type: Nesosilicate
Chemical: Calcium titanium silicate
Hardness: 5–5.5
Acid: Acid sensitive
Heat: Avoid direct flame
Cleavage: Yes, distinct
Toughness: Fragile
Clarity: Translucent to transparent
Color: Yellow, brown, green

Comments: Despite its softness, sphene is sometimes used for jewelry because of its magnificent optical qualities. It is fragile and cleaves distinctly and easily if too much pressure is applied. Watch out for crumbling on girdle and facet edges. Best to go slowly, carefully on this stone. It also fuses quite easily so avoid any direct torch flames or heat.

68. Smoky Topaz (See **Quartz**)

69. Sodalite

Mineral Class: Tectosilicate
Chemical: Sodium aluminum silicate chloride
Hardness: 5.5–6
Acid: soluble in acids
Heat: Fuses fairly easy
Cleavage: None
Toughness: Fragile
Clarity: Opaque
Color: Bright blue, white, gray with green tints

Comments: Can withstand considerable pressure, but avoid using the flame: it often turns material whitish. Acid is rather fast acting (nitric and hydrochloric). Takes good polish, but polish can easily be ruined if polishing wheel contacts it.

70. Spectrolite (See **Feldspar**)

71. Spinel

Mineral Type: Oxides
Chemical: Magnesium aluminum oxide

Hardness: 8
Acid: Insoluble
Heat: Infusible
Cleavage: Imperfect
Toughness: Moderately tough
Clarity: Transparent to Opaque
Color: Red, pink, violet, blue, green, orange

Comments: Hard, tough gem, spinel offers few problems to a setter. Much synthetic spinel, (be wary of much so-called synthetic blue sapphire which is really synthetic spinel) available, and its properties are also hard, tough, infusible, and insoluble.

72. Spodumene

Mineral Type: Inosilicates
Chemical: Lithium aluminum silicate
Hardness: 6.5–7
Acid: Insoluble
Heat: Sensitive to heat
Cleavage: Perfect, sensitive
Toughness: Fragile
Clarity: Transparent to translucent
Color: Clear, pink, green

Comments: Kunzite is the pink/lavender and Hiddenite is the greenish varieties of spodumene. Most faceted gems are oriented so this mineral's cleavage plane—extremely sensitive to shock and pressure—is about 10° away from the table facet plane: thus prong bending pressure is usually directed straight at this cleavage plane. Be careful. Kunzite apparently fades in sunlight (it's been called a night time gem). Both Kunzite and Hiddenite are sensitive to a torch flame.

73. Sunstone (See **Feldspar**)

74. Tanzanite (See **Epidote**)

75. Thomasanite

Mineral Class: Tectosilicate
Chemical: Hydrated sodium calcium aliminum silicate
Hardness: 5–5.5
Acid: Acid causes it to gelatinize
Heat: Heat causes swelling, alteration
Toughness: Fairly tough
Clarity: Translucent to transparent
Color: White and brownish
Cleavage: Prismatic, but not sensitive

Comments: Thomsanite as a distinct crystal is rather rare so not extensively mounted. It's often cut en cabochon, usually from globular occurrences. It is reasonably hard and tough, accepts pressure without undue cleavage danger. Excessive heat will cause the mineral to swell then turn to white enamel-like substance.

76. Topaz

Mineral Class: Nesosilicate
Chemical: Hydrous aluminum silicate
Hardness: 8
Acid: Insoluble
Heat: Not heat sensitive
Cleavage: Perfect
Toughness: Moderately fragile
Clarity: Transparent to translucent
Color: Clear, yellow, pink, blue, yellow, red-brown

Comments: Topaz is a relatively easy stone to set. It's basal cleavage is also usually a minimum of 10° away from the table facet plane. Be careful when applying prong pressure. The mineral also tends to be a bit brittle so stay cautious when working on facet edges and girdles.

77. Tourmaline

Mineral Type: Cyclosilicates
Chemical: Complex borosilicates
Hardness: 7
Acid: Insoluble
Heat: Avoid direct flame
Cleavage: None
Toughness: Brittle
Clarity: Opaque to transparent
Color: Varies: pink, red, colorless, brown, green, blue, violet, yellow, black

Comments: Tourmaline is a very hard but brittle gemstone that usually offers little problem in setting. Be careful when working around sharp, thin edges and girdles because its brittleness prompts crumbling. It's best, too, to keep a torch flame away from tourmaline because fusibility depends upon the iron content. The varieties of tourmaline include:

Name	Color
Achroite	colorless
Rubellite	pink
Dravite	yellow brown to dark brown
Verdelite	green

Indicolite blue
Siberite lilac to violet blue
Schorl black (rarely used in jewelry)

78. Turquoise

Mineral Class: Phosphates, arsenates, vanadates
Chemical: Hydrated copper aluminum phosphate

Hardness: 5–6	Toughness: Very fragile
Acid: Soluble in heated acid	Clarity: Opaque
Heat: Infusible, but at 480° it will turn dull green	Color: Blue, greenish
	Cleavage: Good, prismatic

Comments: Avoid contact with liquids of any kind because they penetrate stone's porous surface, turning it green. Heat will also change color by removing natural water content so be extremely careful when using torch — — not much heat is needed. It chips and fractures (conchoidal) without too much pressure. Don't steam clean or use pressure.

79. Vesuvianite (See **Idocrase**)

80. Zircon

Mineral Type: Nesosilicates
Chemical: Zirconium silicate

Hardness: 7.5	Toughness: Very fragile
Acid: Insensitive to acid	Clarity: Transparent to opaque
Heat: Infusible	Color: Colorless, blue, yellow, red violet, green, brown
Cleavage: Imperfect	

Comments: Zircon's very brittle nature poses major setting problems. Fractures are concoidal, and girdle and facet edges crumble at the lightest pressure. The blue variety called Starlite as well as white stones are heat treated from brown zircons and a torch flame can cause problems: the colors are none too stable in any event because sunlight can often cause a color change. Hyacinth is the name for the yellow-red to red-brown variety. Zircon is easily confused with other bright stones, but its fuzzy, double image appearance at facet intersections when viewed through the table with a magnifier is characteristic only of Zircon.

81. Zoisite

Mineral Type: Sorosilicates
Chemical: Hydrous calcium aluminum

Hardness: 6–6.5	Toughness: Fragile
Acid: Insoluble	Clarity: Usually transparent
Heat: Avoid direct flame, fuses readily	Color: Green, white, pink, blue
	Cleavage: None

Comments: Zoisite must be handled with care because of its softness and fragility. Without too much pressure it will fracture unevenly. It breaks and/or abrades easily on sharp, weak edges. Avoid directing flame at zoisite. The dense red variety is called Thulite while a chromium or strontium containing variety when heat treated produces the tanzanite with a sapphire-like blue. Be wary of doublets. Avoid ultrasonic or steam cleaning.

CHAPTER THREE

Stone Setting Tools

Nothing is more satisfying to a skilled stonesetter than being able to reach casually for just the right tool at the right time. Each profession accumulates a series of tools—tools especially designed to perform specific and, sometimes, a series of tasks. Stonesetting is no different.

A layman glancing over a stonesetter's bench will view a seemingly bewildering array of tools, drills, burs, pliers, clamps, holding devices, files, hammers, etc. It is indeed an imposing display, one that might easily intimidate a beginner. But tools are merely extensions, instruments that expand and magnify a craftsman's hand skills: it has always been so.

It may take a bit of time to understand and grow accustomed to their use. Once this interesting and exciting challenge has been accommodated, it is then merely a matter of skill improvement.

An extensive inventory of tools isn't required to achieve excellent stonesetting results. For an individual wishing to develop a modest capability, such as a jeweler or lapidary who would like to be able to perform routine tasks on their own rather than send them away to a shop, only a few tools may be necessary.

Not all of the tools described in the following pages will be needed immediately, but ultimately you will perhaps be infected by that pleasant malady called "tool collecting" and your tool bench will start "rounding out." Stonesetters, like other skilled craftsmen or mechanics, are constantly in search for that "just right tool"

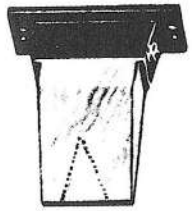
that will improve their performance one more increment—or, hopefully, by a quantum leap.

In buying tools, should you purchase only the best? Certainly good tools promote good results, but there can be no quick and easy answer to such a question. You'll condition your technique to your tools and this eventually will become your setting style. Because changing a tool involves changing your working habits if only temporarily, it's important that your tools be long lasting.

The most expensive tool isn't necessarily the best tool, and realistic decision making has its place. If you will not be working constantly at the bench, if your tools will not be extensively used, it seems perfectly reasonable to purchase lesser cost instruments, replacing them perhaps with better tools as economic conditions and working skills warrant. The important thing is to get started with tools that perform well knowing that even tools of modest cost if used carefully and maintained well will have a long life.

Here, you'll be introduced to most of the important tools that find consistent use among stonesetters. You'll also find recommendations on their applications so as to assure maximum results, as well as techniques on maintenance and preparation techniques where some individualizing is required.

Bench Pin



Whether you use a professional bench or a makeshift one, you'll find that a bench pin with a "V" or "U" slot (for bracing a ring clamp) will provide a handy, steady work platform.

The back of a bench pin is often trimmed so it can be fitted into a rectangular female slot in the bench, or the pin back can be fitted into an auxiliary metal holding frame which is then attached to the bench.

Bench pins are tapered on one surface. Most stonesetters insert the pin so the flat side is up. It's a good idea, too, to cut about a half-inch off the tapered edge so you have a blunt edge (hitting your chest against a sharp pointed bench pin can hurt).

For convenience sake, some setters drill two or three tiny vertical holes in the pin to accommodate and hold the posts when working on ear rings. Also, at the end of

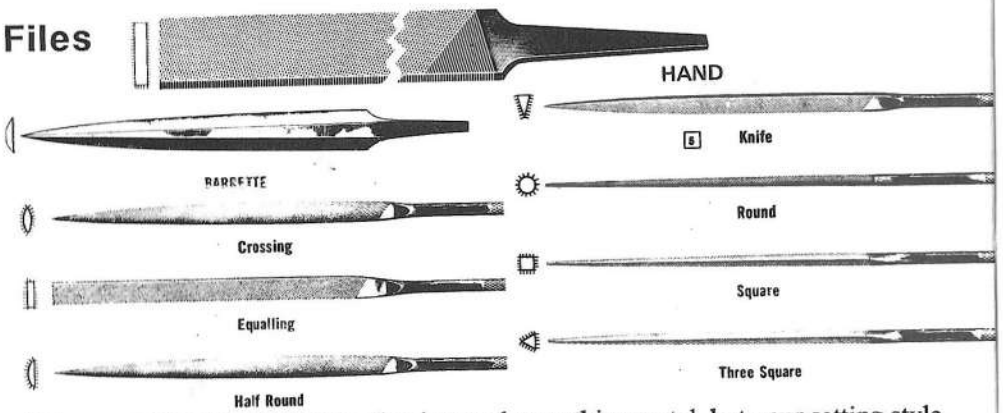
one of the legs whittle or saw out a small trench (to hold a ring shank) with a narrow slit to act as a saw blade guide. This latter adaptation provides a convenient platform for sawing ring shanks during sizing operations.

Ring Clamp

Variations of the basic ring clamp exist, but the most popular consists essentially of two sections of hard wood or composition material that swivel against the ring through a wedging action. Usually the holding ends are lined with leather or a similarly soft material which firms up the grip yet avoids marring the metal.

For added stability, ease, and control, you might consider filing notches or attaching runner strips of leather or wood on the clamp's sides. The strips or notches can brace against the bench pin legs, thus stabilizing the clamp.

Files



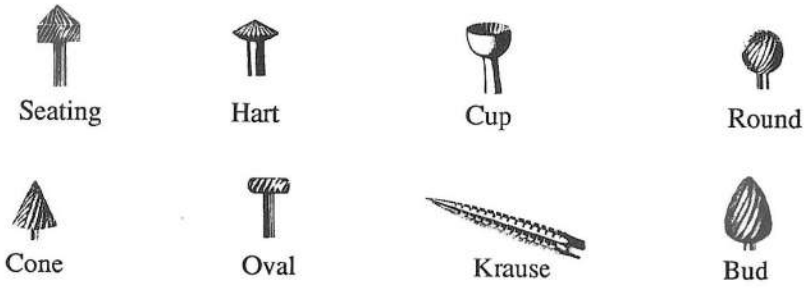
Files are critical for removing, shaping, and smoothing metal, but your setting style will probably evolve into the use of only a few favorite files. The higher the number the finer the file.

For the heavier removal work, you'll want a #3 or #4 flat or hand file. This large file should be complemented with such smaller needle files as a barrette, square, three corner, and flat oval files.

Check the barrette file carefully before using to make certain its sides are flat

and smooth. If necessary polish the sides on an oil stone to remove any rough metal edges. A barrette is used for filing metal close to the stone and the polished edge, riding smoothly on the crystal surface, allows the cutting edge to get in close. The three corner and square file are often used for filing prong notches.

Burs



A selection of high speed cutting burs (careful about that phrase "high speed" because burs cut best and last longest when run at medium speed) provides optimum flexibility in preparing metal to accept gemstones.

The shaft that extends from each bur head is fitted into a handpiece. To avoid excessive wear, the working heads should always be lubricated with either beeswax or Oil of Wintergreen. Stone-seating burs can be obtained either with both end and side cut or with an end cut and safe side. They come in graduated sets from 1.0 mm (size 1) to 10.0 mm (size 30.)

The 45° hart bur (there is also a 90° bur) is useful for cutting seating notches in prongs and occasional routing. It, too, comes in graduated sizes.

Sometimes it is necessary to rout out or enlarge a previously drilled hole before the seat is cut. This is done effectively by a bud bur or a cone bur. In a pinch or in the absence of a stone-seating bur, the cone bur can be used to cut out a seat. These burs come in various sizes.

Removing excess metal that might interfere with the setting is performed quickly with a round or krause bur. This is especially true in complex or tight corner situations where other burs can't reach these difficult spots. Round and krause burs come in graduated sizes. Round burs are useful, too, for cutting bearings.

A cup bur with its hollow, conical tip is a convenient tool for rounding off prong tips. Many cutters simply lower the bur onto the tip and finish off the rounding prior to pulling the prongs down. The oval bur is useful for cutting a bearing notch

by tilting the bur head as it cuts into the prong. Both cup and oval burs come in graduated sizes.

Prong Lifter

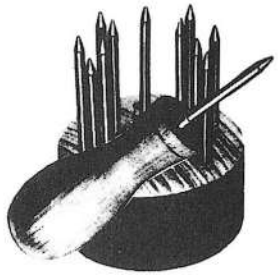
Sometimes you wish to lift a prong that didn't go down quite right or you want to remove a stone from an existing prong mounting. The prong lifter, made of hard steel with sized lifter grooves, will safely pry a prong away from a stone.

Drills

Drills are particularly useful for the initial piercing of metal. A #80 drill is the smallest, a #1 the largest. For stone setting you'll find that a few drills between #60 and #80 are sufficient.

It's a good idea to break a #60 to #80 drill in half so only 1/4" extends past the hand piece. Lubricate a drill with Oil of Wintergreen or a light cutting oil. To sharpen a drill, insert a separating disc in a flex shaft. Grind a 60° angle and then turn the drill slightly to cut a 12° lip angle. Incidentally, if you snap off a steel drill in a precious metal mounting and can't remove it, just heat the mounting in a saturated solution of alum and water: the steel will dissolve.

Beading Tool



Beading tools feature smoothly hollow, conical tips in graduated sizes (like the cup bur but without cutting teeth) which are used to round off and burnish correspondingly sized prong tips and beads. While a major function involves the cosmetic rounding of metal the pressure applied, particularly when setting melee or pavé, also forces the metal down tighter over the stone.

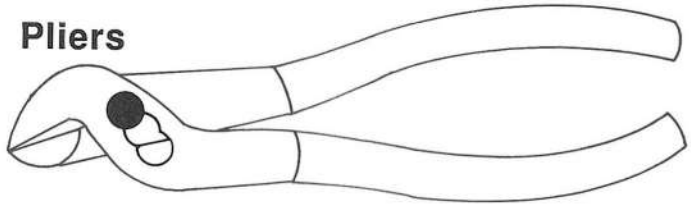
Through continued use, the conical hollows break down and must be restored. This is done on a beading tool plate. Such a plate contains a series of hardened steel

beads in eight standard sizes. The end of a worn or misshapen beading tool is hammered over these steel beads.

Remember: beading shafts are sold new as hardened steel. They must be annealed before use and preferably annealed again before being reconditioned on the beading tool plate. To anneal, play a torch flame on the shaft tip until it turns to a cherry red color (about 1400° F). Allow it to cool naturally on a charcoal block. Then it's ready to be reworked on the beading plate.

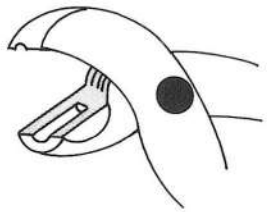
Starting with the smallest bead on the block, place the hollow shaft tip over the bead and tap the other end sharply with a jeweler's hammer. Proceed to progressively larger beads until you reach the desired bead size. This method avoids excessive stress on the tip at one time and helps keep the concavity centered.

Pull-Down Pliers



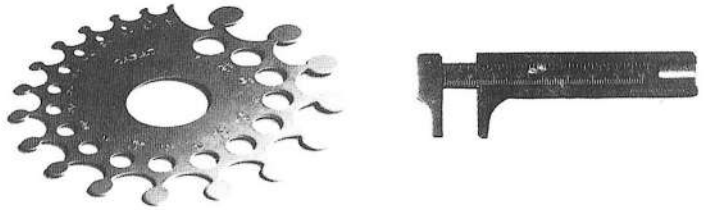
Squeezing or pressure control, especially with pliers, when manipulating prongs or metal over the stone often is an anxiety arousing test for many stonestetters. This problem is greatly reduced by Pull-Down Pliers, an adaptation of an existing small utility plier design.

Pull-Down Pliers have smooth, off-angled V grooved jaws that allow you to equalize prong pressures on the jaws rather than at their tips while at the same time giving maximum squeezing control. The bottom jaw groove can be fitted over a prong stem while the opposing jaw groove grips the prong tightly and bends it over the stone. With these safeguards, pulling a mounting off center because of excessive pressure is now virtually eliminated. The angled jaws allow the stonesetter's wrist and hand to be carried at a more comfortable, controlled position than when using standard pliers whose jaws are directly in line with the handles.



For settings where the prongs are not opposite (ovals, cushion, emerald, etc.), the lower jaw can be snugged against the bottom of the cage while pressure from the top jaw closes down on the prong tip.

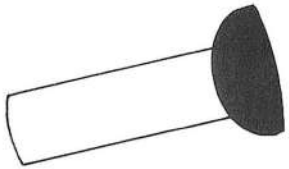
Gauges



Most of your measuring will consist of matching gemstone size to the mounting, but occasionally you'll need to identify metal thicknesses to assure that it can accomodate a stone's depth.

The ligne degree gauge has been the traditional device. More and more setters use a slide gauge and/or a stone gauge. The latter offers the advantage of measuring both stone diameter as well as bur sizes, too. The stone gauge allows you to evaluate a stone's diameter by pushing the stone through a series of sized holes. Cutouts on the outer perimeter of the stone gauge provide for a convenient and accurate appraisal of the setting size in that you can place the cutouts into the setting to check the fit.

Cement Stick

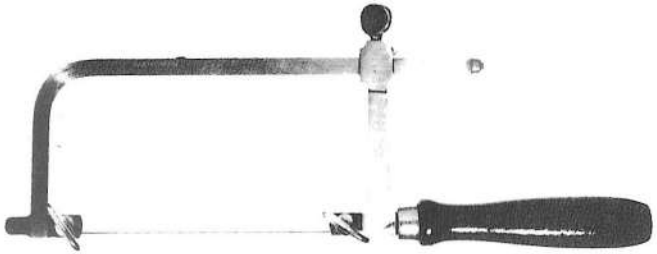


Cement sticks come in handy for providing a steady work platform for small mountings that can't be conveniently gripped on the bench pin or in a ring clamp. A stick consists of a wooden dowel with one or both ends encased by a flattened wad of dopping wax or, preferably, lapidary cement. The wax/cement can be flame melted and then dripped onto the dowel tip or a melted puddle can be created in a heated container and the tip dipped in until there is a sufficient buildup on the stick.

About an inch in diameter, the dowel needs to be long enough to provide a firm hand grip while bracing the dowel against the bench pin. Mountings are first heated slightly and then delicately pushed into the warmed wax or cement which quickly hardens into a secure lock. To make the stick ready for use, heat soften the wax/cement and the mounting with a torch, then carefully with tweezers plant the mounting so the work area is exposed.

Lapidary cement is tough and will quickly wear down steel tools so be careful. It's a good idea to chip away any excess wax around the mounting that might interfere. To remove, heat the mounting, pull it out with tweezers and let soak in denatured alcohol until the residue can be removed easily.

Saw



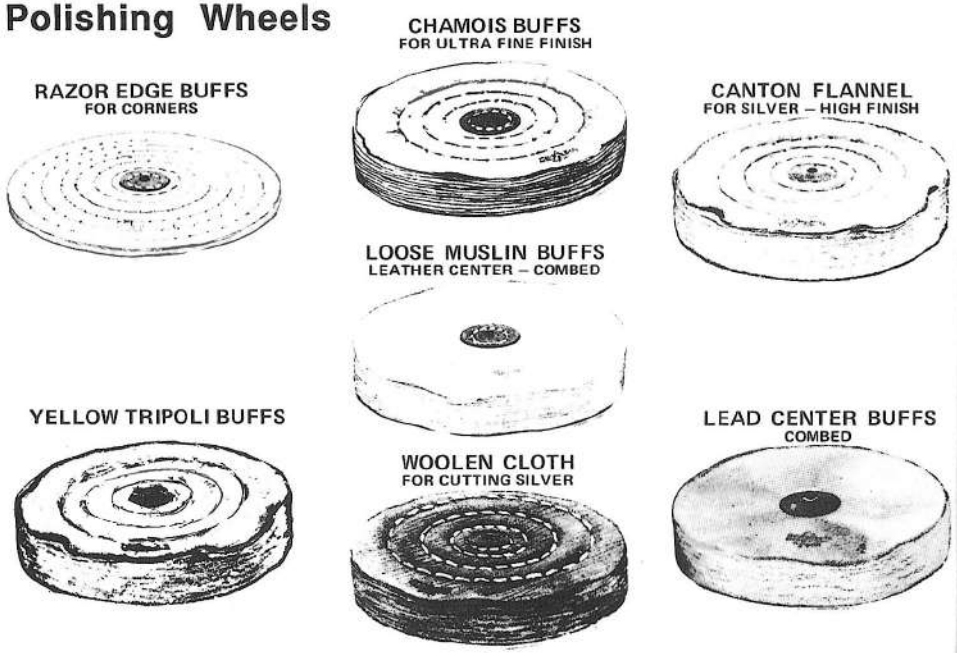
Used by jewelers for cutting metal and producing profile or pierced work, a jeweler's saw is invaluable for removing sprues from cast mountings, separating prongs and fishtail settings, and a host of other difficult tasks that other methods just can't handle.

Saw frames of various depths are available. The shallower frames are a bit less clumsy. As for blades, the higher the number the finer the cut (a 6/0 blade is very fine while a 3/0 blade cuts a relatively wide swath). Insert one blade end, turn the saw frame upside down and brace the front against the bench pin with the handle against your chest. Now, push your chest against the handle, compressing the steel frame. With the frame compressed, lock in the other blade end—then release pressure. The blade is now under tension and should ping when plucked.

Hold the saw vertical when cutting, and apply cutting pressure on the downstroke, releasing on the return stroke. Cut rhythmically—and let the blade do the cutting. Any twisting or gripping or abrupt forcefulness on your part and the blade will likely snap. When that happens you can either insert a new blade or adjust the frame to accommodate the shorter blade.

To lubricate a saw blade, rub a block of wax along the back edge of the blade. This enables heat generated from the sawing friction to melt the wax which then can run into the teeth evenly and eliminate clogging.

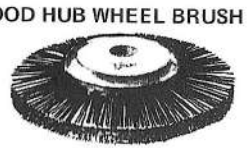
Polishing Wheels



Metal polishing is a process of eliminating surface irregularities that interfere with disciplined light ray reflections. This means progressively removing scratches, nicks, dings, etc. until a smooth, mirror-like surface is achieved. For this reason, it's important to remove all rough evidence of tool work. Small 5/8" knife edge pumice wheels are ideal for this function. After a prong or bezel has been turned over the stone and filed, a quick, controlled touchup on the remaining rough surface—right down to the stone—can be performed with the small wheels...but be careful. Those little wheels can abrade a facet edge, too.

A final polish on prongs or bezels is possible with small muslim or hard felt 1/2" or 7/8" polishing wheels. You should have at least one wheel charged with tripoli and a second charged with rouge. **Important:** *wipe the setting off after applying tripoli so you don't contaminate and ruin the rouge polishing wheels.* A fine commercial product, Fabulustre, is finding increasing use because it allegedly performs the fine abrasive smoothing and the polishing action simultaneously: use your own judgment as to the polish's quality.

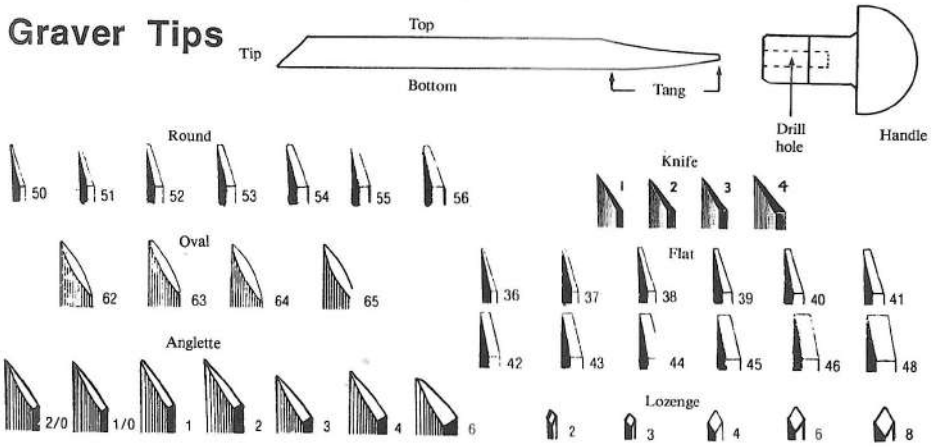
Bristle Brush



The polishing of fine jewelry is effectively achieved with rouge or Fabulustre on a short black bristle brush. By trimming the new brush's bristles into a knife edge, polishing action at sharp angles and in small crevices can be noticeably improved. Many setters singe the brush over an open flame. Then while the brush rotates on a motor spindle a piece of coarse carborundum or broken crucible is held against the flat bristles to shape them to a pointed edge.

The same black bristle brush is also available for use in a flexshaft handpiece. These smaller brushes don't need trimming.

Graver Tips

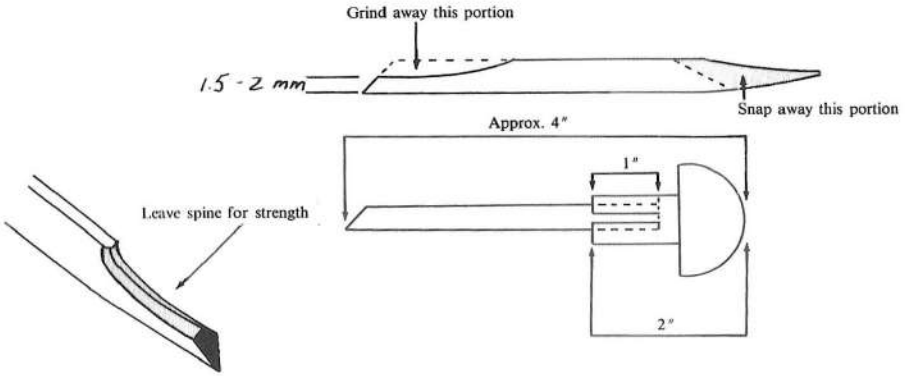


To the beginning setter, gravers can be most imposing. Not only are these tools nowhere near ready for use when new, but they must be constantly re-sharpened, sometimes polished, often re-ground or re-faced—and using them efficiently is a continuing learning process. All this, it seems, just to cut metal by hand.

Once a setter develops proficiency with gravers, though, his or her mastery over cutting precious metal expertly and aesthetically reaches new heights. Recognize that expert use of gravers takes time, patience, and practice...practice...practice.

Graver blades, of course, are made of hardened case steel with tips of various

shapes, angles, and lines.



The variety of sizes and styles is extensive in response to the variety of work or use for which they are intended. With time you will acquire a particular type and size, but even an advanced setter can get away with a set of five or six gravers. Once your technique has been refined you can try variations.

A good beginning set would include a knife edge, #1 or #2, a flat graver, #30 or #40, and round gravers,#52 and # 54.

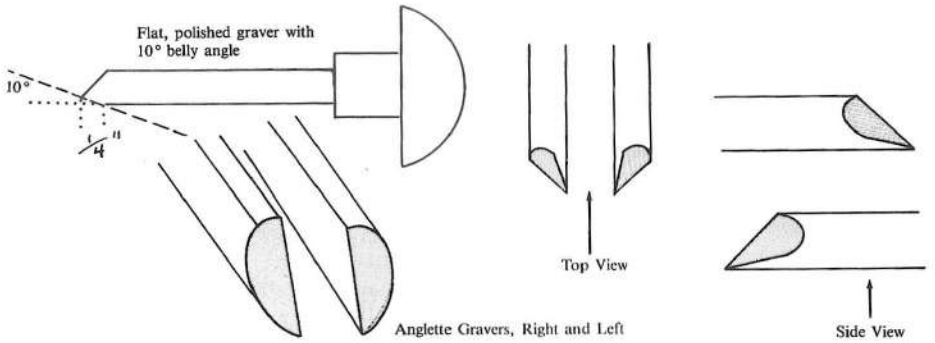
When purchased new, gravers are too long and must be individualized to fit your hand. When a complete graver—blade and handle—properly fits snugly into the palm of your hand, the cutting tip should extend no more than 1/2" beyond your thumb tip. Actually, it's not inappropriate for the thumb tip to touch the mounting while you're working with a graver. These specifications generally produce an average man's length of 4 inches, and a woman's of 3-1/2".

To measure your hand, hold a ruler in the working hand as if it were a graver. Figure two inches for the wooden handle, with one inch of the graver steel to be inserted into the handle stem. Remove the excess length from the back, or tang, portion of the blade by breaking off the unwanted, protruding portions with a quick hammer tap. The blunt tang should then be re-sharpened on a grinding wheel so it can more easily be driven into the handle.

When grinding a graver blade it is absolutely essential that the hard metal not be softened so grind slowly and use water after every short swipe on a fine machinist's grinding wheel. Also wear goggles for eye protection and stand to the side when you first turn on the machine (any existing crack in the wheel can send pieces flying).

Drill the wooden handle about 3/4" so it will accept the graver blade. Make a quick check to confirm the proper length before driving the handle completely onto the tang which is gripped tightly in a bench vice. If your wooden handles have a flat surface, keep the flat part and the cutting edge on the same side.

For the most part, gravers are supplied sufficiently sharp to use. The flat graver is often given an additional 10°-15° belly angle, extending back from the tip about 1/4". Sharpen the graver's belly on an India stone, followed by a fine Arkansas stone. The rounded knife edge (also called an anglette or onglette) gravers are usually given an additional left and right angle cutting face (some manufacturers can supply you with anglettes already prepared with such cutting faces) so they will more easily and efficiently cut the left and right sides on flat plate bead setting.



Anglette Gravers, Right and Left

A further modification practiced by many setters involves grinding down the forward section of the blade as a visibility aid and to allow the smaller 1-1/2 to 2 mm tip to get into small crevices.

Sharp gravers make for easier work so keep your gravers in top cutting condition. In the area of routine sharpening, keep the Arkansas stone on your benchtop. When you wish to sharpen a graver, and this should occur after every few cuts, follow this general procedure:

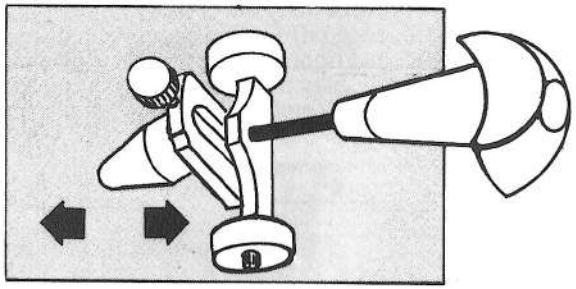
—Place some lubricating oil on the stone
—Hold the graver inverted with its tip against the stone at the appropriate angle
—Using an elbow action with the arm, hand, and wrist held rigid to avoid any faceting (change of plane) apply sharpening pressure on the forward (away from you) stroke and release on the back stroke (you'll get edge rounding if you lift at the end of the forward stroke).

Note: Inexpensive mechanical sharpening devices complete with rollers are available from most jewelry suppliers if you don't trust handholding or lack sufficient practice opportunities. These devices will hold the blade at the proper angle—but they do take a bit of time to set up.

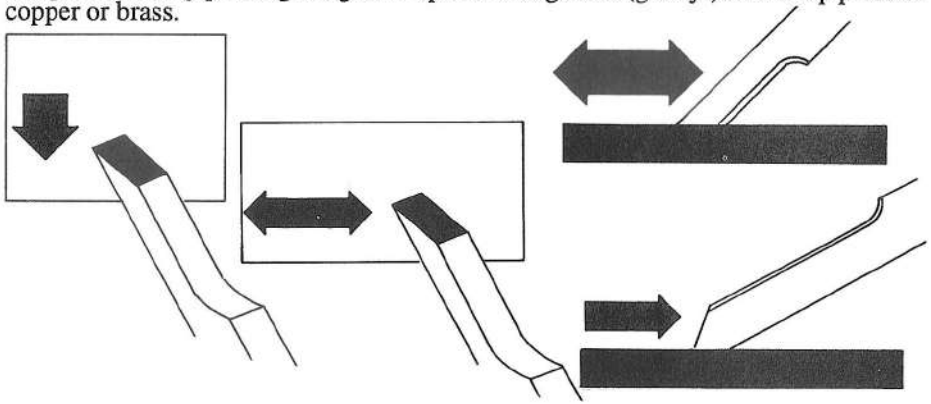
Even if you make a few errors in the beginning you'll be much better off working

to develop a talent for sharpening and polishing your graver without mechanical aids: it's so much quicker by hand.

PLACE WOODEN HANDLE IN PALM OF HAND AND SHARPEN TOOL WITH BACKWARD AND FORWARD MOVEMENT ACROSS STONE



Sharpening often leaves a small metal bead or slivers on the cutting edge. These can be removed by gently punching the cutting edge into a wood block. Check for sharpness, too, by pushing the graver tip into a fingernail (gently!) or a scrap piece of copper or brass.

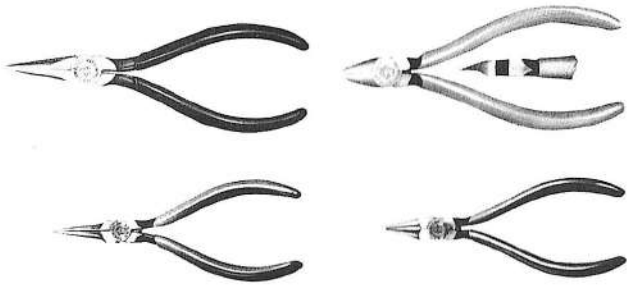


Because they are used for bright cutting, the cutting edges of flat and anglette gravers are kept brightly polished, using a No. 4 emery polishing paper on a glass or flat metal plate. Some setters polish by pulling the graver tip back toward themselves (the preferred way) with a series of short strokes while others insist that a sidewise motion improves results by eliminating the rounding problem. You'll need to be your own judge on that, but remember that the original contours of the cutting edge must always be maintained on all sharpening and polishing operations.

You'll also need to re-polish the bright cutting edges every few strokes. Before you resume cutting, check to make sure the highly polished metal is even across the

tip. To support your cutting efforts, soak a wad of cotton with some cloves or wintergreen oil and use it to keep your gravers well lubricated.

Special Use Pliers



Getting a mounting ready so you can begin actual stonesetting often requires some preliminary adjustments such as metal removal, prong or bridge adjustment, etc. For such general work, you'll want:

Chain Nose Pliers—for turning down, straightening out, bending, and/or squaring up prongs, fixing or adjusting bridges or the body of the mounting, gripping, twisting, etc.

Cutting Pliers—for removing metal such as prong tips, small casting sprues (large ones are better sawed off).

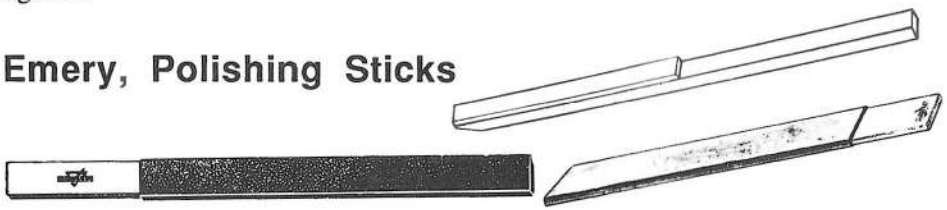
Special Purpose Pliers—any number of other special purpose pliers are available such as claw stretching pliers, prong bending pliers, etc. These other types can be added to your workbench as your preference dictates.

Mandrel

Specialized mandrels exist for a number of uses—rings, bracelets, necklaces—even as forms for shaping different mounting frames. The most immediately essential mandrel will probably be a grooved metal ring mandrel which is useful for sizing rings, especially when stretching or hammering, as well as for offering a stable work platform during hammering type heavy ring work. A mandrel is normally inserted tightly into a receiving hole in the side of the bench. This setup also allows for easy removal when the mandrel is not in use.

The purpose of the groove is to provide a safety space cavity for gemstone pavilions that might extend below the bottom of the ring cage. In order to keep the ring from slipping, wrap a thin section of rubber around the mandrel then snug the ring up to a tight fit.

Emery, Polishing Sticks



More and more stonesetters are now utilizing fine abrasive wheels in their flexible shaft systems for shaping and smoothing metal, but a supply of emery paper is still useful for the odd job in removing abrasions and scratches. The higher the grit size number the finer the grit: No. 4/0 is the finest, used for polishing gravers.

Commercial emery sticks are inexpensive, but you can just as easily wrap the emery cloth around a thin stick and secure it with thumb tacks (score the material first on the back with an awl or graver tip so you can fold it crisply). No. 1 emery grit and the finer No. 4/0 polishing cloth should cover your needs.

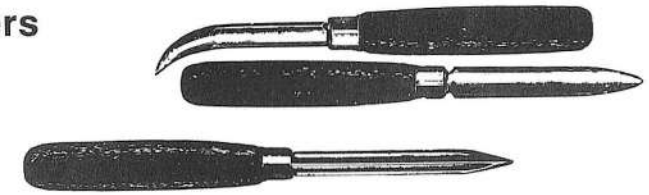
Divider

A diamond or stone not level in the setting is quickly spotted. That's why cutting the seating notches at a uniform level is so vital.

As your experience grows, you'll soon learn to eyeball the average setting job. But many times, particularly with fine, expensive jewelry work, even experienced professionals prefer the accuracy of a pair of steel tipped dividers which can

inscribe the exact girdle location. These same dividers are also vital for marking spacing between stones in multiple mounting situations such as clusters, pavé, and the like.

Burnishers



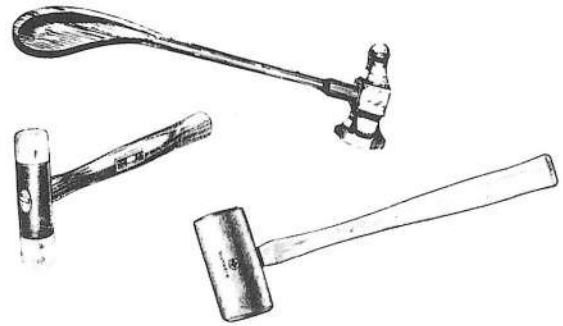
Burnishers offer two functions: 1) they are efficient for working metal over stones, and 2) they make good polishing tools. Because gold and silver are so malleable, burnishers also serve to form and shape metal.

The standard burnisher is a wood handled instrument with either a straight or curved shaft of polished steel about 1-1/2" to 3" long. A smaller burnisher can be made from an old beading tool shaft whose tip has been ground round and then polished. It's effective for working the inside rims of bezels.

In the Orient, a highly effective polishing burnisher, called a "sang ling," consists of a 6-inch wooden handle into which has been fitted a 1-inch highly polished sharp pointed steel blade. It's small and allows a craftsman to get into tight places to polish prongs and bridges on mountings—plus chains. Used in conjunction with the lather from the Buah nut—a hazel-like nut—the sang ling produces an excellent polish.

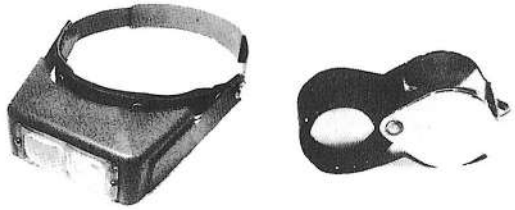
Note: A bezel roller is also a handy tool for rolling bezels around stones in rings, brooches, pendants, etc. The half-round, highly polished steel head is pushed up forcefully against the bezel and then rotated upwards toward a vertical position, pushing the metal tightly against the stone.

Hammers



For metal working where the work must not be injured or marred, a rawhide or plastic mallet is ideal, but for all around general jewelry use a chasers' or ball pein hammer finds the greated use. It's the large flat surface on a chasers' hammer, complemented by an angled pistol grip handle, that provides maximum hand and stroke control for flattening objects and striking chasing tools and punches.

Loops, Magnifiers



Many setters perform much of their work without the assistance of magnifiers, using them only for checking at the end of the job. A 10x magnifier is about the maximum needed, although most bench magnifiers feature much less magnification than that.

Many different designs exist, from box loupes to single eye loops. Gaining recently in popularity are the lower powered headband types which can quickly bring the work into magnified view with a tilt of the hand or a hand flip.

Gem Pushing Tools, Powder Bag

Sometimes, especially when a gem is friction fitted into a mounting, you need to pressure a gem into its bearing. When this can't be done simply with a finger, a gem pushing tool comes in handy. Some setters prefer a metal rod, about 3/16", embedded in a wood handle, similar to a beading tool. Others insist on a wood stick to minimize the chance of marring or injuring the stone. The tip of a brass or wood

rod will perform and should be made slightly concave to avoid slippage.

To reduce glare—particularly when doing pavé, cluster or bead work—it's helpful to coat the work with powder. Ordinary talc powder wrapped in a cloth or in a porous small bag offers you the convenience of giving the setting an occasional swat so you can more easily watch your progress.

Bench Block

A bench block is useful for a number of functions, most of which involve hammering or percussion. In Western countries this consists usually of a block of hardened steel about 4 inches square.

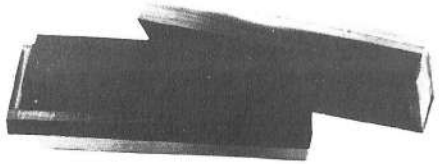
Many oriental jewelry craftsmen follow centuries old tradition and use a simple block of Nephrite jade as an anvil or bench block. The jade is soft which minimizes any damage to soft metals—but jade is one of the toughest minerals of all...and it doesn't rust, dent, or bend.

Flexshaft

In today's diamond and stonesetting shop the high speed flexshaft is a mainstay. The most popular model is the suspended motor vs. the on benchtop model. When using the flexshaft tool, though, keep in mind that few operations require or even want the top speeds that are available.

Most burs and tools used in the flexshaft perform better at middle or low speeds.

Sharpening Stones

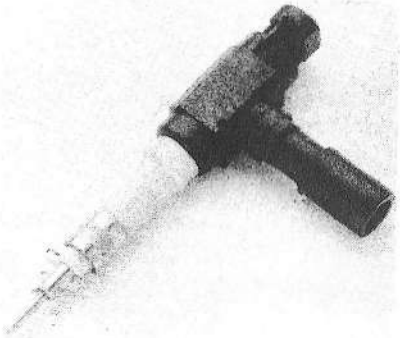


For shaping up gravers you'll want the coarser white Arkansas stone , with the finer black stone to impart the desired sharp cutting edge. For ease in use, a stone with dimensions approximately 6x2x1 offers a sufficiently large working surface.

It's possible to obtain a single stone with a coarse grit on one side and the finer grit on the other.

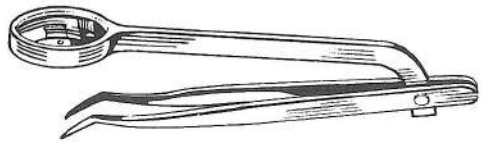
Smaller stones, called slips, are available but many feel they're a bit clumsy to work with, allow oil to drip off onto the bench too easily, and don't offer a large working surface. But—they are cheaper.

Flexshaft Hammer



Hammer handpieces that fit onto the flexshaft unit are available and they speed up the hammering process while offering consistent stroke control. A recent development that has proved a boon to many setters is the new Innovator hammer. It's a small, economical yet powerful tool driven by the flexshaft and can be equipped with a series of interchangeable hammer heads for special purposes.

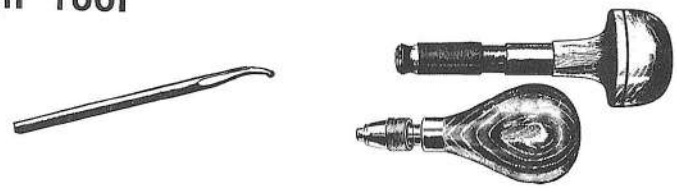
Tweezers



For handling tiny stones and metal parts, the tweezer is almost indispensable. You'll undoubtedly find that tweezers with serrated tips provide the most secure grip.

Be wary about allowing your tweezers, which are often chrome plated, to be placed in bench chemicals such as pickling solution, untrasonic liquids, etc. Use copper prongs only in pickling solutions: they can take the chemical assault.

Milgrain Tool



A milgrain tool consists of a wooden handle and a series of interchangeable stems containing cupshaped cutting wheels, used for imparting a decorative beaded edge on settings and jewelry. The concave shaped wheel is merely run back and forth a few times over a sharp surface and the cutouts in the wheel round off the metal, producing the beaded effect. Contemporary use of milgraining is declining.

A Starter's Tool Kit...

The tools described in this chapter by no means exhaust the extraordinary range of tools available to a stonesetter. There is simply too much technology in the trade to allow that kind of limitation.

Nor does the inclusion of a tool in this description mean that it must be a part of your equipment inventory. The search goes on continually for that one new tool that will provide a breakthrough solution to a difficult setting challenge. At the same time, setters are ingenious in their own inventiveness for adapting existing tools—plus tools used for other crafts or applications—to their own needs.

But, is there such a thing as a starter's list of tools...the principle instruments necessary to carry a beginner through just about every kind of setting challenge? At the expense of predictable controversy, here is a list of tools that perhaps should be considered the bare essentials:

1. Round bur, size 0/11
2. Hart bur, size 0/15
3. Stiff bristle cleaning brush

4. Scriber
5. Ring mandrel
6. Flat hand file
7. Burnisher
8. #4 3-cornered file
9. Shellac stick
10. Divider
11. Chasing hammer
12. Snipe nose pliers
13. Flat prong pusher
14. Ring holding clamp
15. Flex shaft
17. Wax block
18. Ruler gauge
19. Bench pin
20. Pull Down Pliers
21. Alcohol lamp

CHAPTER FOUR

General Skill Techniques

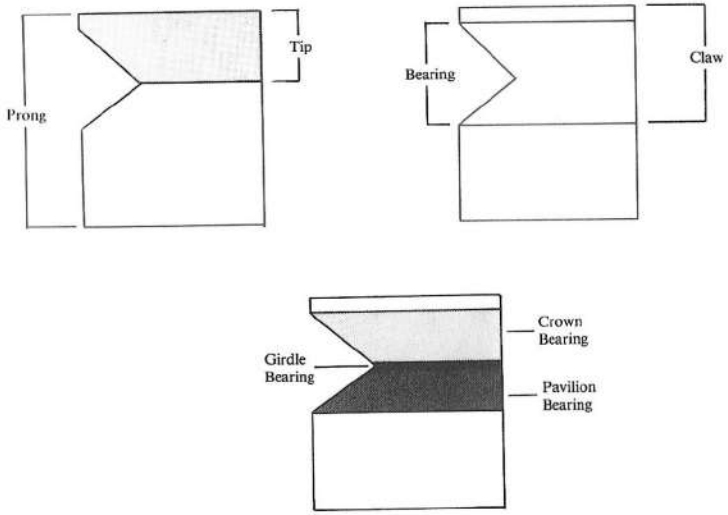
A variety of techniques and tools are available for just about every setting challenge. That's what makes diamond and stonesetting the exciting and interesting craft that it is. Beginning with Chapter Five you will be introduced to the general procedures for the three basic types of settings: prongs, beads, and bezels.

Before proceeding with these steps, though, you should familiarize yourself thoroughly with the definitions used in stonesetting as well as a variety of specialized techniques so you can better use the various options that are available to you. Some of these techniques are used more than others, and many you will later modify or vary. In the beginning, it is advisable that you practice each operation described in this chapter as much as possible, working to develop a maximum proficiency for performing these repetitive but highly important techniques.

Of course, some of the methods given here you will never use, or perhaps use only rarely. Still, by including them into a single chapter you will have each available for quick reference or as a ready aid in overcoming a difficult or puzzling setting situation.

Inasmuch as subsequent instructions will refer to various parts of a jewelry mounting it is best to have firmly in mind the names or labels for these specific references. One of the major problems in the gemology and jewelry industry is the absence of clear, universal definitions for many of the terms. What is a claw to one

individual may well be the entire prong to another, yet the differences between the two labels pose a significant communications problem.



Most of the terms demonstrated above can be applied to all three types of mounting technique. Although a channel may be considerably longer than a prong it is still useful in both cases to refer to the section that grips and holds a stone as the claw or bearing. The tip is still that metal portion which extends from the top of the stone to the girdle.

Except in the case of gypsy mountings, it's seldom that a claw is used in bezels: the stone normally rests on a smal flat raceway or ledge but the vertical bezel still represents a bearing which must be burnished or folded down over the stone.

Subtle Differences in Approach...

Despite their radical differences in appearance, the actual setting techniques between prong, bezel and bead methods are not all that disparate.

In the sections that follow every effort has been made to demonstrate these subtle differences. Bending a wide prong tip over a stone's girdle calls for much of the same skills and discipline as folding a channel tip over a row of stones.

Cutting Out Bearings on Prongs...

Fortunately for the craft of stonesetting, no single best approach exists for cutting out prong bearings on mountings. A variety of tools and techniques are always readily available, and most stonesetters are equally adept with all of the alternatives. It requires only a slight change in conditions to warrant a different approach and your own versatility, the ability to recognize and respond to a particular situation, is the hallmark of stonesetting professionalism.

Generally speaking, setters use gravers, files, cutting burs and/or a variation of these tools to get the job done. With increasing experience, a preference for certain approaches develops, but the willingness to shift quickly to another method—even to making up a solution—remains if the setter is well enough equipped with fundamental skills.

Indeed, when cutting prongs with a bur there isn't even a consensus if it's better to cut prongs with an oval, seating or hart bur. And if a seating bur is chosen, do you use a bur whose diameter is identical with the stone or do you select a smaller bur in order to minimize chattering or vibrations that might enlarge the opening?

In response to the above question, the criticism against using a same size bur is that it is virtually impossible to eyeball the cutting progress with enough accuracy and control that each prong is cut identically.

Also, the problem of vibration and chatter often means that the final bearing size could possibly finish up larger than the bur size. By using a bur smaller than the stone diameter, some setters contend, each prong can be cut carefully and accurately with metal left over for trimming away snags and spurs while still eliminating any overcut danger.

Many setters resolve the above quandary by restricting use of same size burs to setting stones .20 carat and smaller. On larger stones, where holding the handpiece steady and true is much more difficult, a smaller diameter bur is used to cut the prongs separately.

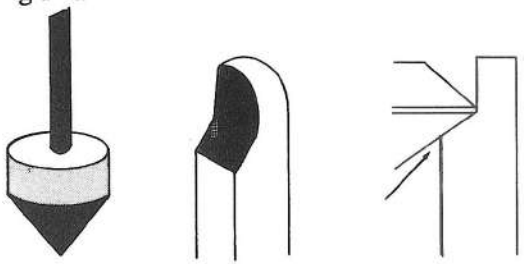
Arguments Against Seating Bur Overuse...

Then, too, there exists a large group of professional stonesetters who believe that seating burs are used by beginners—and some experienced craftsmen—entirely too much. Indeed, they should seldom be used for notching prongs at all. The feeling is that prong bearings are best cut with hart, round or oval burs and then the stones snapped into place and tightened.

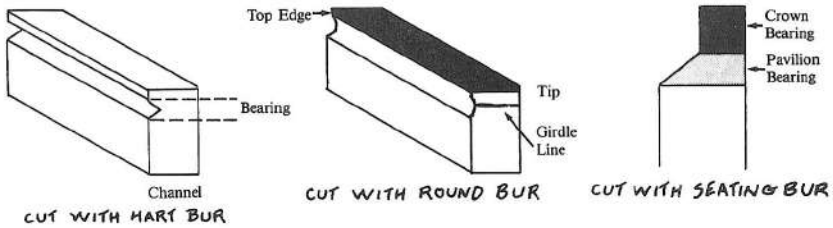
As for seating burs, these critics say, use them where intended, for preparing

tiny prong mountings or plate surfaces to accept bead set stones. By preparing prongs/bevels with seating burs which leave a vertical crown bearing, you commit yourself to the need for a) bending the metal at a more acute angle; b) more finishing or tapering of the back of the prong, and c) more work to finish the tip properly. This problem is exaggerated when you use seating burs in gypsy, channel, and tube setting situations.

The prejudice against indiscriminate use of seating burs rests on another criticism. When a stone is set in a bearing made by a seating bur the pavilion fit is so excessively tight that the stone may not properly be cleaned later—even with the use of an ultrasonic or steam cleaning unit.



These reservations are not without solid foundations. It is recommended that when you reach for a seating bur to cut out a bearing you first ask yourself: is there another technique? The contention that the stone's pavilion must fit exactly to the metal bearing for security reasons is not totally justified. Actually, in many cases it's better if the pavilion *doesn't* fit exactly to the pavilion bearing.



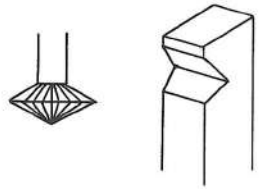
The above comments are not intended as a diatribe against the use of the seating bur which is a splendid implement. It is only meant to warn you against utilizing these burs as knee-jerk applications to most setting problems where perhaps better approaches, albeit a bit longer, are available to you.

Regardless of the approach you ultimately select, following are most of the basic

alternative procedures for cutting prong bearings:

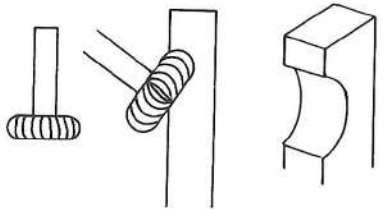
NARROW, SMALL DIAMETER PRONGS

Hart Bur



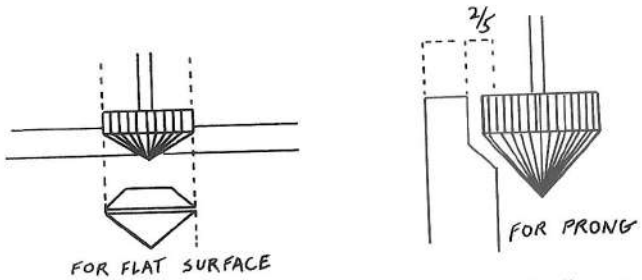
1. Select a 45° hart burt whose diameter is smaller than the width across the prongs. Check it for clean teeth then secure it in the handpiece. Lubricate it. At medium speed introduce the bur's outer cutting edge to the girdle marking on the prong, with the bur tilted at a slight angle.
2. Rotate to a vertical tilt on the bur as you cut into the prong to a depth that is 2/5th of the prong's diameter. (Most faceted gemstones are cut with pavilion angles of 41° to 43° and the bottom of this hart burt is 45°. By rotating the bur to the vertical you assure a reasonably tight fit between the stone and the bearing.
3. If a rounded tip is desired, finish off the tip with an appropriately sized cup bur. Rotate the cup bur to assure a complete rounding of the tip then remove any metal burrs or snags with a flat graver, fine #6 file, emery stick or knife edged pumice wheel.

Oval Bur



1. Oval burs are available in various sizes. Select the bur whose oval most closely resembles the bearing size you'll need. Check it for cleanliness and then insert into the handpiece. Lubricate well (in the absence of a lubricant or sufficient speed oval burs hve a tendency to grab a prong and run around the side, tearing up the metal).
2. With sufficient tilt that the cutting edge forms a complete bearing silhouette, cut into the prong 2/5th of the depth, with the outside rounded edge of the bur cutting at the intended girdle line.
3. Clean up the bearings with a fine #6 rat tail file, emery stick, or knife edge pumice wheel. Brush clean.
4. Tighten the tips over the stone with pliers or a prong pusher.

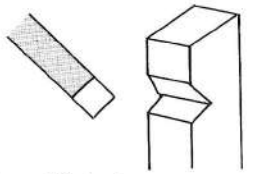
Seating Bur



1. Select a bur whose diameter is equal to or less than the stone's diameter. Check to assure that no metal filings from previous work sessions remain between the bur's teeth. Wire brush clean if necessary. Lock the bur into the handpiece securely, then lubricate the bur with beeswax, (plunge the bur into the wax while turning at slow rpm) or touch all sides of the non-turning bur to a wad of cotton saturated with Oil of Wintergreen. A bottle cap makes a convenient holder for the cotton.
2. Bring the bur down straight and level so the bur's sides cut into the prong about 2/5th of its thickness. Cut to the girdle mark using minimum pressure: let the bur do the cutting.
3. Taper the back of the claw, if necessary, so it will bend without the need for excessive pressure.
4. Clean away and smooth up any metal burrs or snags with a flat graver, #4 file, emery stick or a 5/8" knife edge pumice wheel.
5. Use pliers or a prong pusher and bend the prongs down flat on the stone.

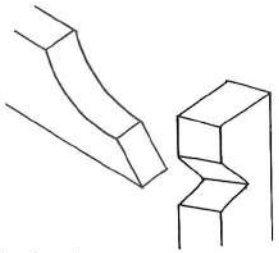
then remove any indentations or surface damage to the metal and polish.

Needle File



1. If prongs provide sufficient space to work with a file, select either a fine #4 square or three-cornered file.
2. Place the file's cutting edge on the girdle line and carefully file notch to 2/5th depth of prong thickness. (A short 1mm wide "V" trench whittled into your bench pin will serve as a convenient "holder" for most prongs while you file the notch.
3. Trim any burrs away with a file, flat graver, emery stick or knife edge pumice wheel.
4. Snap the stone into place, tighten with a prong pusher.

Flat Graver



1. It's more difficult and takes longer to cut out a prong bearing with a flat graver, and the difficulty seemingly increases as the mounting size grows smaller (less room to manipulate the graver cutting face).
2. Brace the mounting so the graver pressure won't bend the prong. To make the gravering easier on all claws, cut straight into the prongs at their girdle lines with a 6/0 saw blade or with the flat graver. Then working from the top of the prongs, first, cut the crown bearing toward the girdle line until the bearing is 2/5th deep into the prong.
3. To avoid interference from the opposite or adjacent prongs which often prohibit a direct access to the work area, work the graver at a slight cross angle to

rough out the pavilion bearings. A #4 barrette file can be used to smooth out the bearings...if there's room to work.

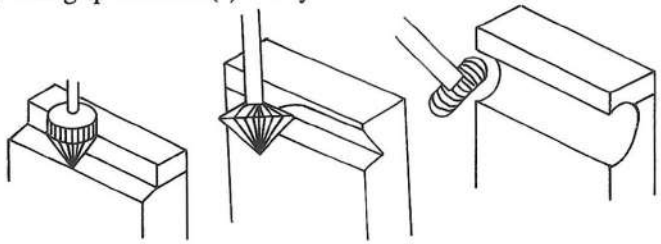
4. Cutting bearings with a flat graver generally leaves little residual cleanup. Shape the tips and snap the stone into the claws.

FLAT, WIDE PRONGS AND CHANNELS

High Speed Burs

1. For straight, continuous bearings, mark the girdle line with a steel scriber or dividers. Select the appropriate bur and check for clean teeth. Insert in the handpiece and keep the bur well lubricated throughout the cutting chore. At medium rpm, introduce the outer cutting edge of the bur to the girdle line in the center of the prong and work toward the outside edges. Keep the girdle line straight, even, cutting to 2/5 depth of prong thickness.

Note: A small hart bur is an excellent choice for cutting individual bearings for round stones. Place the bur on the girdle line mark and simply press the cutting edge into the metal, cutting matched notches in both channels. Minimal bending pressure is needed since the bearings will grip the stone(s) firmly.

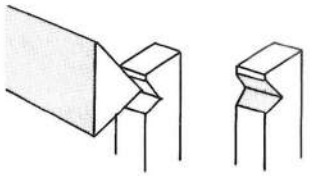


2. Smooth out the rough metal left in the bur cuts with a flat graver, working across the bearing with smooth, straight strokes. Just trim, don't remove excess metal.

3. A straight bearing can accommodate single or multiple stones whose girdles are straight as well as curved: it's a matter of working the metal over the stone neatly. Sometimes, though, in a single stone situation the girdle curvature is sufficiently severe in relation to the prong width that you should make some accommodation in the bearings for this disparity (it's generally not good setting practice to utilize wide prongs on small rounded stones where this condition becomes a serious problem).

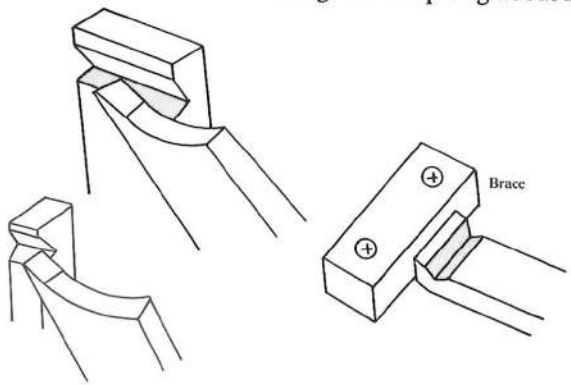
If a long bearing must be used for a single round smaller stone, round the bearing track slightly by cutting the outer section of track shallower than the center (unless you can successfully bend the prongs edges around).

File



1. For a row of small stones, place the cutting edge of a #4 three-cornered or square file on the marked girdle line and cut the entire bearing into the prong about 2/5th of the prong's thickness.

Graver



1. Mark the girdle line with a steel scriber or even start the cut with a 6/0 saw blade. Saw into the prong about 1/3th the prong's thickness.

2. With a flat graver, cutting across the prong, shave the respective bearings down until the girdle line is 2/5th of the prong's thickness. For a wide, flat prong that is intended for a round stone, you may wish to round out the notch, using a 5/8" pumice wheel or a round ball bur.

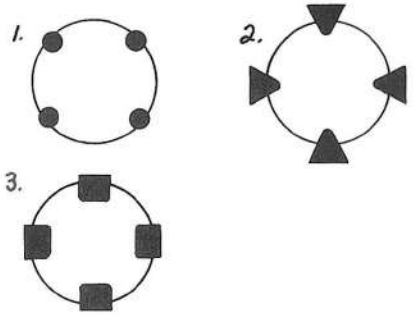
SHAPING PRONG TIPS

In most cases, the intended shape you want for prong tips should be one of your first decisions. Because it's relatively safer to work with metal near the hard diamond than it is near the more fragile colored stone, you can often leave most of the prong tip shaping until last when setting diamonds.

For colored stones, it's good strategy to minimize the amount of necessary metal work once the stone has been set. Colored stones are too easily chipped or abraded even under the most careful working habits. For this reason—it's even a good practice to follow with valuable diamonds—most prong tips should be roughed in with a file or graver after you've finished making the bearing cuts but before setting the stone.

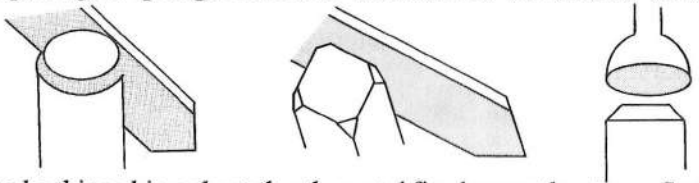
Only the touchup shaping and polishing of the prongs then needs to be performed as part of the finishing work.

Variations for shaping prong tips are many, but most setters confine the tip shapes to one of the following three: 1) rounded; 2) triangular, or 3) modified square or rectangle.

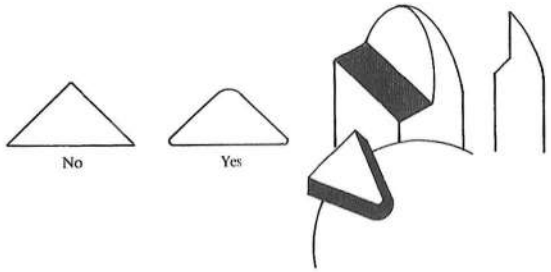


Rounded

1. If possible, it's best to round a tip even before cutting the bearing (especially if the bearings are cut with a file or hart bur) because metal is often taken off the top in the rounding operation and this can possibly introduce differences in prong height. When tips are rounded initially, you can subsequently check the prongs for uniformity, then mark the girdle line to assure the stone will seat level.
2. Smaller prongs can be rounded with a lubricated cup bur: larger ones, of course, will require a fine file and/or small abrasive wheels in a flexshaft. It promotes working speed and accuracy if you file off the sharp tip edges before using the cup bur (lengthens the working life of the bur, too). The final removal of file marks can be left until the last operation because some surface damage may occur when pulling the prongs down over the stone...or the back of the claw may need to be thinned in order to lay the metal firmly over the stone. Such contingencies may require a re-use of the cup bur as well. Still, rough metal and burrs should be removed immediately with a graver or emery cloth after the tips are rounded.

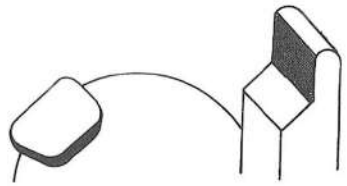


Triangular



1. Thin down the back of the tip, if necessary, so the metal can be pulled down on the stone without undue difficulty.
2. Roughly shape the tip with a fine file or abrasive wheel. Be careful about the tips: blunt them slightly because real sharp tips and edges snag on clothing.
3. With a graver or pumice wheel, bevel back the two leading edges slightly.
4. Trim off burrs and rough metal with a fine #6 file, emery stick or small pumice wheel.
5. Do final touchup and polish in closing operations.

Modified Square, Rectangular



1. Trim off excess metal from the back of the tip, if necessary, to reduce bending

pressures.

2. With a fine file or abrasive wheel, shape prong with either truncated or squared off corners (the sharp corners slightly blunted, of course). The front of the tip may curve down to the stone, or be beveled back with a flat slope by a flat polished graver or abrasive wheel.

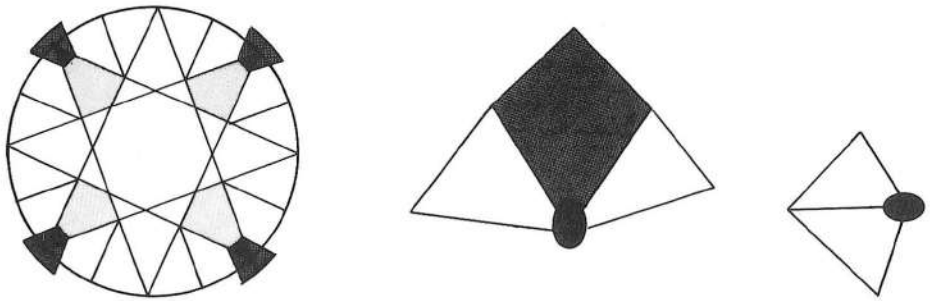
3. Use a fine file or emery cloth to remove any burrs or rough metal. Avoid sharp edges or corners.

4. Do any required final polishing as a closing operation.

Setting Stone "Square On"

Setting a diamond or colored stone "square on" contributes not only to the symmetrical appearance of the final job but to the security of the mounting as well. It's especially important to set diamonds "square on" in pavé or cluster situations because the consistency of alignment and repetitive design provides an overall impression of unity.

Square-on setting is often misunderstood. It's easily demonstrated with a 4-prong mounting where each claw is placed against an opposing crown main or bezel facet. Also, "square on" applies primarily to round brilliant cuts.



With a round brilliant stone set in this "square on" style, you will notice a number of advantages:

1. Tips are brought down flush on the largest, flat facet area available, promoting

strength and security. If the tip were turned over the girdle halves, maximum pressure would be brought to bear on a sharp, weak facet edge and the metal would need to be burnished down over at least two different angles.

2. The facet arrangement is consistent with the mounting and when this pattern is repeated as in pavé and cluster situations it promotes a pleasing appearance.

Note: The objective of a stonesetter is to create the most pleasing effect. If a stone has an unsightly inclusion or blemish and this imperfection can be minimized or hidden by the judicious placement of a prong then "square on" ambitions should be subordinated to making the stone look good. In short, first use the prongs to cover any unsightly stone defects where possible and then consider a "square on" orientation.

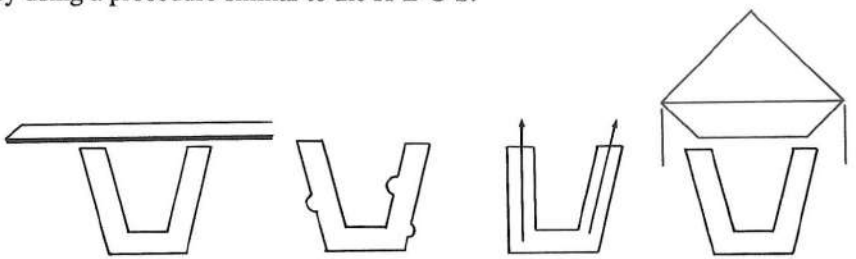
EVALUATING MOUNTINGS

Professional diamond and colored stone setting can be reduced to a single observation: plan your work and then work your plan.

Try to make your decisions at the onset as to how you intend to proceed with a particular setting task and then do your best to stick to those decisions.

It takes only a few moments in the beginning to allow for a thoughtful pause...to study and evaluate the mounting, to decide upon the strategies you intend to use...to run through a mental checklist. By developing a procedure, you assure yourself of a more thorough examination and eliminate difficulties once you've begun the actual work.

Try using a procedure similar to the H-E-C-S:



H = HEIGHT Are prongs or bezels of same height? Lay the mounting on a flat

table surface or a flat hand file so you have a reference plane for eyeballing the result. If one element is longer or shorter, it will show up and the condition can usually be corrected easily by filing until all edges show filing marks.

E = EVEN Are all the parts even in thickness, straightness...are any prongs tipped sideways or bent? Are all prongs or bezels inclined the same, either vertical or slanted? Does the angle of one or more need to be adjusted. Any irregularity can be spotted easily enough and straightened or repaired with a pair of chain nose pliers. Remember, gold is malleable, and can be stretched and shaped—even welded—in a cold state.

C = CLEAN Is the mounting clean? Whether die struck or cast (cast mountings tend to be much harder and thus a bit more unruly when it comes to bending, stretching, etc.) does it need some repairs or preparatory work before it's ready for use. Cast mountings usually require extensive preparation to remove sprues, teats, overflow and metal globules, burrs, snags. These must be ground away and smoothed. Die struck mountings may also need some sanding or touching up. Check the mounting carefully for anything that might disfigure the final work if it goes unnoticed.

S = SIZE Will the stone fit the mounting? That's the most important question of all. It's not unusual to set a stone in a mounting made for another size. You can usually modify a prong mounting to accommodate a stone with a size difference of approximately 25% by bending prongs, cutting metal, etc. You might be pushing your luck—or involve yourself in more extensive metalwork—if you try to exceed that margin. Measure the stone carefully, then measure the mounting (a stone gauge is very handy for this task): do they match...or can they be made to match without undue alterations?

CALCULATING BEARING DEPTHS

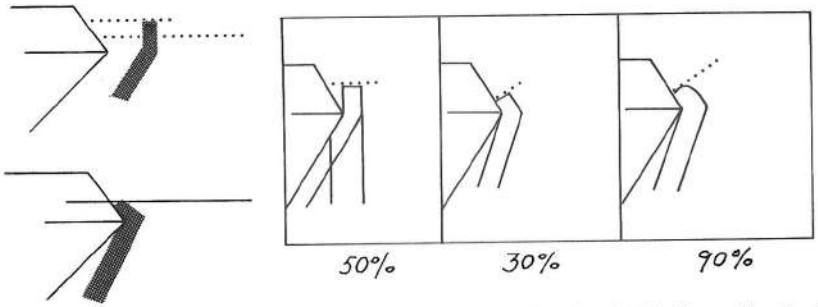
One of the seemingly more difficult challenges for the beginning stonesetter is determining the proper depth for the bearing so just the right amount of metal is available for a secure, attractive, and appropriately sized claw.

The depth, of course, will vary according to the size and cut of the stone as well as the characteristics of the mounting itself. As a rule of thumb, you should mark the girdle line for a 30-50-90 arrangement so as to provide the following:

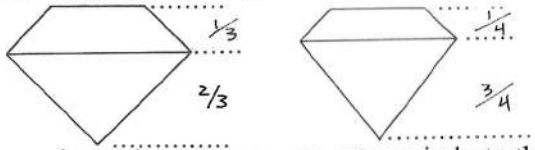
1) With the stone seated in the bearing, the upright edge should extend to about 1/2 (50%) of crown height.

2) When the metal is pulled down on the stone, it should extend 1/3 (30%) of the distance from girdle to the stone's stable.

3) The prong's tip should be roughly perpendicular (90°) to the crown angle.



It's not difficult to determine a precise measurement for the girdle line. Study the drawing here of a round brilliant stone. Notice that in a normal cut, the crown takes up 1/3 of the stone's height and the pavilion takes up the remaining 2/3.

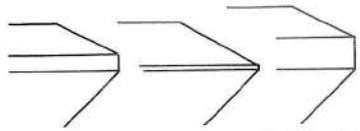


Exception: Oriental Cuts

Not all stones, for various reasons, are cut precisely to these dimensions, but a quick eyeball check of the stone's profile will reveal the exceptions.

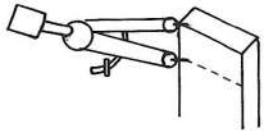
Note: Most of these exceptions will occur with foreign (so-called Oriental cuts often have rather shallow crowns) mixed cuts whose pavilions tend to be thicker (step cuts are better for showing color and by thickening the stone the cutter can usually improve the color).

To determine the girdle line, measure the depth of the stone from culet to table and multiply this measurement by .33. This will give you the stone's approximate vertical crown height. Half—or slightly more than half—of this vertical crown height represents the proper vertical height you want for prong material above the girdle line. In dealing with larger stones, or stones with thick or faceted girdles, you'll want to adjust these dimensions.



Faceted girdles need a wider girdle bearing, to avoid chipping the sharp edges. A thick girdle needs similar special girdle attention, to avoid difficult space gaps later. It's always best anyway to provide yourself with a bit more metal height than you'll need—just as a safety precaution in case you need to remove more metal from the tip than anticipated. It's easy to remove metal: it's something else when

you run short and trap yourself into an unwanted re-tipping situation.

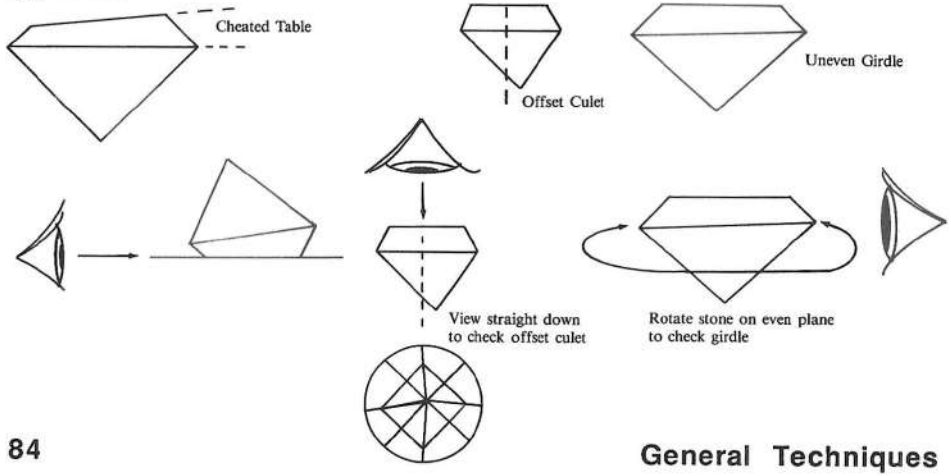


The preferred method for actually marking the intended girdle line is with the use of dividers. Adjust the dividers for the required distance, setting the arm pointers against a ruler or the markings on a sliding gauge. Measuring from the top of the tip, use the other steel pointer to score the girdle at the precise depth, and then repeat this process around the bezel or for each of the succeeding prongs.

A steel scriber is a good marker but depends on visual estimating accuracy. As your experience increases, you'll soon acquire this ability to eyeball with acceptable results—but the divider will always remain the most reliable method.

Caution: Before going ahead with the girdle line marking, make sure you evaluate the stone carefully for any "cheating" (slight deviations from normal cutting angles) or "swindling" (severe deviation from normal cutting angles). To hide a flaw, remove an obvious inclusion or mineral abnormality, make the stone look bigger, or to disguise a previous cutting error, it is not uncommon for diamond cutters or lapidaries to alter standard cutting practice and/or proportions.

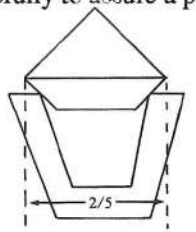
This could produce a stone with an uneven girdle line, a table that is seriously tilted away from level, or a shape that is non-round, non-symmetrical, or poorly proportioned. As the setter, you have the responsibility to make the stone look as good as possible—and this means that you may have to make adjustments in the mounting itself. Conceivably, you might not want each prong's bearing cut at the same level. If you're dealing with a stone whose girdle is crooked you might need to cut some bearings higher on one side, or set the stone at an angle to make the table appear flat.

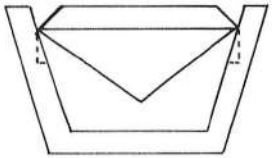


To check a stone for a crooked girdle, place the stone table down on a flat surface and evaluate the girdle against the flat, steady reference point as you slowly revolve it. Is the culet off center? You can check that, again by placing the stone table down, and eyeballing the culet to see if it wobbles during rotation. Or you can peer straight down through the middle of the table and confirm if the culet reflection remains centered during rotation.

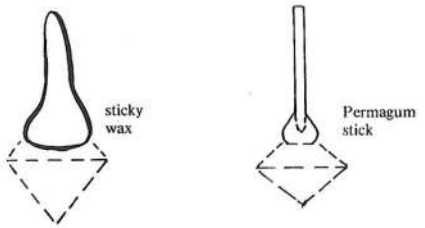
CHECKING STONE FIT: PRONGS AND BEZELS

Before proceeding with any setting operation, the stone size should be checked carefully to assure a perfect fit between the stone and the mounting.





Two methods for size checking are used, the on-top and the inside method. If the prongs incline outward at a sufficient angle, just place the stone inside the prongs on the level position and mark with a steel scriber. This method is used mostly for stones with non-round shapes although it is also used for round stones as well.



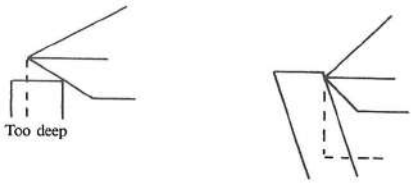
When checking stone and mounting fit on the inside of the prongs a cylinder of sticky wax is most helpful. The cylinder is much easier to handle than a small

gemstone so you can work faster, slipping the stone in and out of the prongs without the additional problem of dropping. (Rather than traditional wax, some setters now use an inexpensive proprietary material called Permagum, a sticky sealing compound with strong holding ability: it's available from any refrigerator wholesale house.) Once inside the prongs, the stone should be leveled and then checked to see that it touches all prongs evenly. Correct any prong deviation with a pair of chain nose pliers. When the fit is precise, scribe the girdle line.

The second method is to turn the stone upside down and place it on top of the prong tips. This method is used mostly when the prongs stand more vertical and/or when they are thicker. The stone should cover no more than 1/3 of each prong's thickness. Correct any variation from this measurement with a pair of pliers, adjusting until the stone rests evenly on all prongs.

If you wish to enlarge a mounting by bending all the prongs outward by the same amount you can rock a pair of chain nose pliers against the prongs. An optional approach is to use a round-ended repoussage tool whose diameter is equal or slightly smaller than the mounting opening. Push by hand or lightly hammer the tool down inside the cage so the prongs are stretched or bent simultaneously.

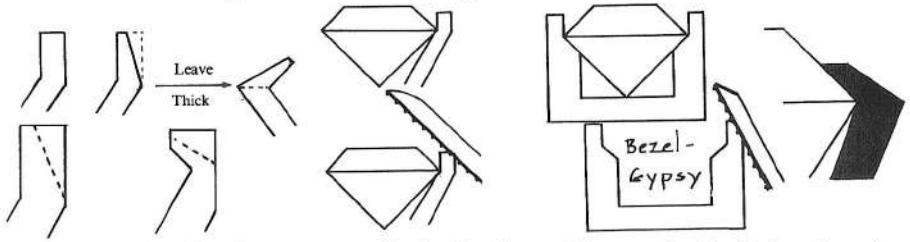
Once you have achieved an appropriate accommodation between the stone's size and the mounting, the bearing can be cut with the girdle line at the proper depth.



TAPERING PRONGS AND BEZELS

By thinning the metal —usually with a hand file—on the upper outside of the claw

the need for excessive pressure when bending claws over the stone is eliminated.



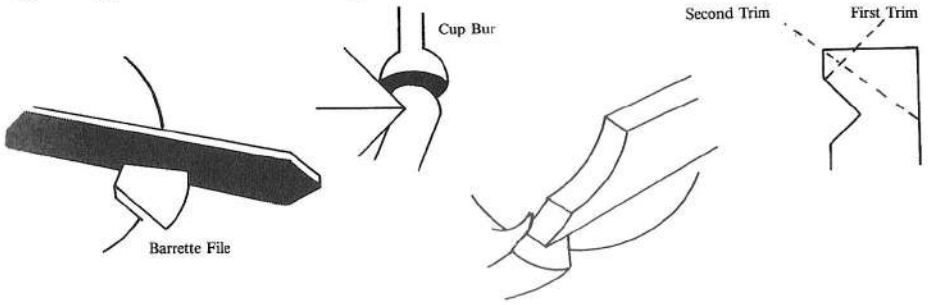
If the crown bearing is cut perpendicular (such as with a seating bur), the trimming and thinning should provide for a final tip level sufficient to extend up the required 1/2 of the crown's height, providing for the 1/3 measurement when the crown bearing is pulled down over the stone.

If the complete bearing has been cut (as with a hart bur, oval bur, or a file), the thinning with a file would be approximately parallel to the crown line. Again, it's important to leave the area directly behind the girdle line thick and strong: this is where the most bending moment takes place and where the setting is subjected to the greatest wear and tear.

To avoid doing it later with the stone in place, consider, too, the advantages of shaping up the leading edge of the tip so that it's nearly perpendicular to the angle of the crown bearing. When the tip is pulled down on the stone, only a minimal amount of touch-up will be required.

FINAL SMOOTHING OF PRONG TIPS

Despite your best efforts at pre-shaping prong tips, bezel or channel prior to stone tightening, some final smoothing must be done to achieve a finished job.



For these final tasks you'll mostly use cup burs, flat graver and/or fine needle files. In the process of hammering or pulling down metal over the stone it's not

unusual to mar the finish slightly. In final finishing, the simple rule is: for long, flat planes use long flat tools such as files, emery sticks, hard felt buffs, etc. Small flexshaft wheels run the risk of rounding edges, uneven planing—which are noticeable. Use these tools in smaller areas. When working next to the stone uses a flat graver or barrette file.

For a rounded bead, just bring the appropriate size cup bur down over the tip, keeping the edges of the bur off the stone as much as possible.

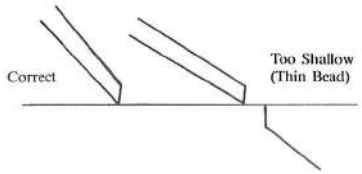
STARTING A BEAD

Raising a bead from a flat piece of metal really isn't all that difficult. The tools, if prepared and used properly, will do most of the work.

What few differences in procedure there are depends entirely on the size of the stone that's being bead set.

For stones with a diameter of 4 mm or less (that's approximately .25 carat size), you can proceed directly to raising a bead without the necessity of making any preliminary cuts or metal preparation. Using an oval graver or a #53 round graver, place the graver point down on the top surface of the plate about 3/4 mm from the edge of the stone.

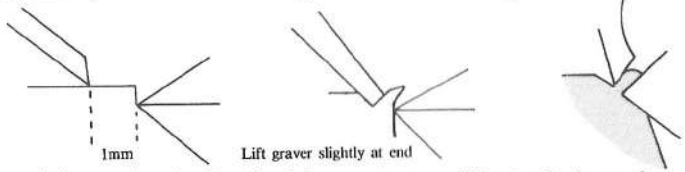
Caution: Many setters work the tips too much. Truth is, to round a tip with a file you need only to give each of the leading edges a light touch with a needle file: the action of the buffing and/or polishing wheel will round off the tip nicely.



The angle of the graver to the flat surface should be about 45°. One of the mistakes often made by beginners is to concentrate on immediately digging the graver point deeply into the metal at a steep angle and then rotating the graver to an even more vertical stance so the graver face will wedge the metal spur forward over the stone.

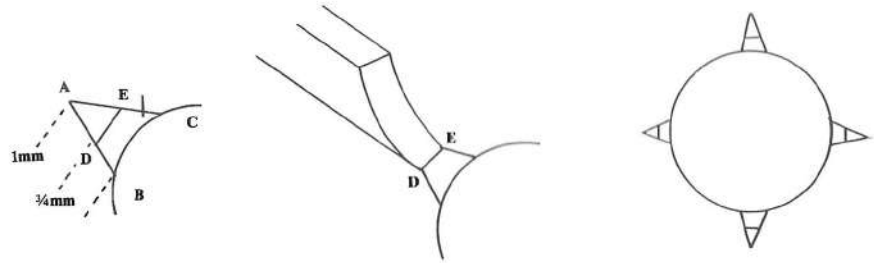
Indeed, some instructors emphasize this technique. There's a much easier way...a variation of production beading.

The graver is initially pushed downward at a 45° angle to start the cut. But once the graver face has penetrated the metal slightly, lower the angle slightly and push toward the stone, scooping up metal with the face of the graver. Stop just short of the bearing hole, and lift the graver slightly. The resulting small mound or spur of metal can be easily burnished and shaped over the stone girdle with a beading tool.



You'll need larger beads for the bigger stones. The technique described above works quite well for larger bead (you start back a little farther from the crown bearing edge, about 1 mm). On larger beads, though, a bit of preliminary metal preparation can make the task a lot easier:

Starting about 1 mm behind the actual bead location, use a knife graver to cut a V slot leading to the stone hole. Cut over the two lines A-B and A-C a couple of times to slice out a distinct trench. Then use a round graver at the same 45° angle, starting about 3/4 mm from the hole edge at line D-E, and scoop up a bead.



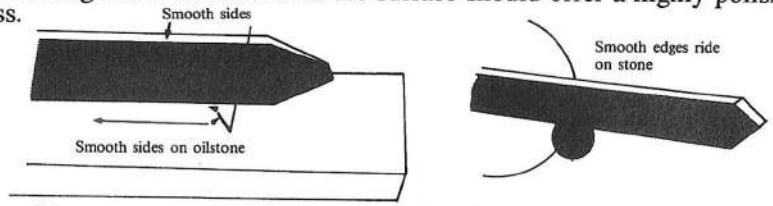
Once you've penetrated the metal sufficiently, lower the graver angle and push and waggle the graver tip toward the stone, scooping metal toward the edge. Stop short of the hole and lift the graver, spilling the metal toward the stone girdle. Shape and burnish the metal bead tight with a cup bur.

From the foregoing descriptions, you've probably concluded that the expression, "raising a bead," is a slight misnomer. You're quite right. What really happens is the bead is forced down over the stone girdle.

PREPARING A BARRETTE FILE

The best file for working with metal near the stone because of its smooth edges which ride harmlessly on the stone surface, a barrette file comes new with smooth sides. Often, though, a bit of extra preparation is warranted.

Turn the file on its side and check its smoothness with your fingernail. There should be no roughness whatsoever as the surface should offer a highly polished smoothness.



To achieve this necessary smoothness, use an abrasive wheel to smooth down both edges of the file. Finish up with a fine grit silicon carbide paper and then lap the two surfaces with such proprietary compounds as Zam or Diamantine.

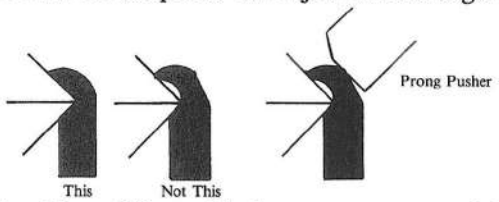
TIP TIGHTENING TECHNIQUES

Claws and bezels should be tight to the surface of the stone. This promotes not only stone security and appearance but avoids dirt clogging and snagging.

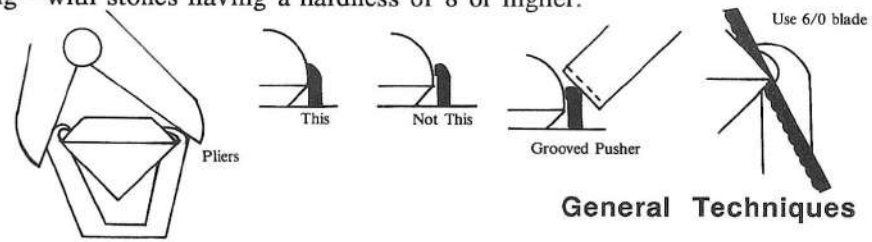
Check carefully to see that no gaps exist between the crown bearing and the stone's surface. If any gap does exists remove it before proceeding any further.

Evaluate the situation carefully. Often, a bit of extra pressure with a prong pusher or the judicious use of a hammer and flat punch will do the job. As an alternative try the Pull-Down Pliers or regular setting pliers with their lower jaws braced against the bottom of the cage while the top jaw brings pressure down directly on the gap section.

A piece of cloth slipped between the pliers' lower jaw and the cage will help avoid disfiguring the metal.

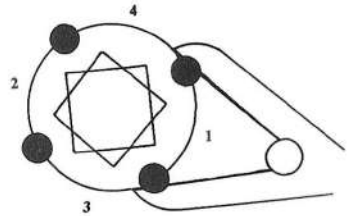


If you are still having trouble, a 6/0 saw blade can remove metal from the crown bearing—with stones having a hardness of 8 or higher.



Also, don't overlook the possibility of thinning the back of the tip area some more so as to make the metal easier to bend (not so thin, though, that you unduly sacrifice the claw's holding strength.)

Once the metal is down flush, grasp the stone(s) with a pair of tweezers and attempt to rock or twist it in the setting. Does the stone wobble if one side is pushed down with a graver tip? Does the stone move or shift when the girdle is probed lightly with a graver tip? At the slightest sign of looseness, go back to tightening.

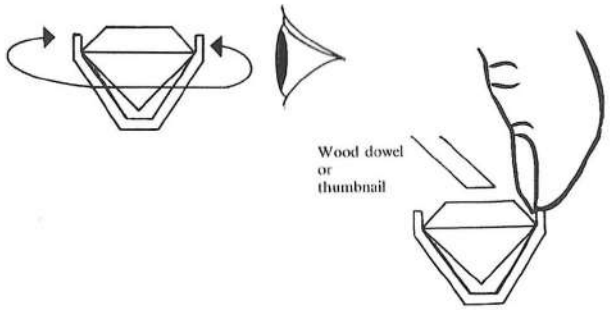


For prong set stones, an excellent technique for strengthening the grip of prongs already pulled down in place is vector tightening. It's quite simple to do—and quite effective.

Using a pair of pliers, grasp two opposing prongs at girdle level (careful you don't scrape the stone's girdle!) and gently squeeze the claws toward each other. Proceed to the opposite side of the stone and repeat. Do all four sides in the same manner, and the stone will be firmly grasped by all four claws.

TESTING FOR SEATING LEVEL

To check a stone for level in the setting use a cylinder of sticky wax to place the stone in the bearing. Eyeball the girdle for a consistent level as you turn the stone and mounting a full 360°. At a minimum you should view the stone for level in at least two positions.

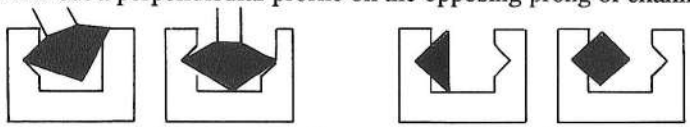


If the stone doesn't appear level, check to make certain the girdle is fitted into each claw properly. Push the stone into the bearings with your fingernail or a wood dowel (avoid using the graver tip for this task: too dangerous!).

UNDERCUTTING PRONGS, CHANNELS

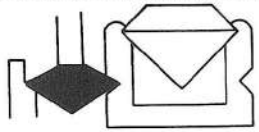
Where it is difficult to bend or manipulate metal prongs or channels over the stone and especially where metal elements must remain in place as a securing post for more than one stone, undercutting is a valuable technique.

For the most part, undercutting is accomplished with a hart bur although a round bur or a 3- or 4-cornered needle file, if there's room enough to work, will serve very well. With a hart bur, the quickest and easiest procedure consists essentially of introducing the bur at a slant to undercut a bearing into one side, then rotating the tool so that it will cut a perpendicular profile on the opposing prong or channel.



Best results will be attained if you choose a hart bur that is the same diameter as the stone or—as some setters prefer—a slightly smaller bur. Undercut the first bearing at the proper girdle level about 2/5th of the prong's thickness while holding the bur at a slight angle as shown. Then simply tip the bur up straight and slice into the opposite claw, cutting the crown bearing perpendicular.

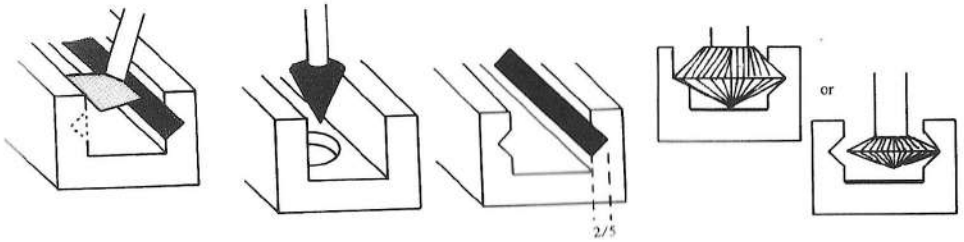
In those cases where a prong must remain in place to serve as a brace for other stones, undercut only about 1/3 of the prong's thickness before rocking the bur to vertical. You want to leave sufficient metal thickness so the prong can serve its dual role as a claw for one stone and a stable brace for another.



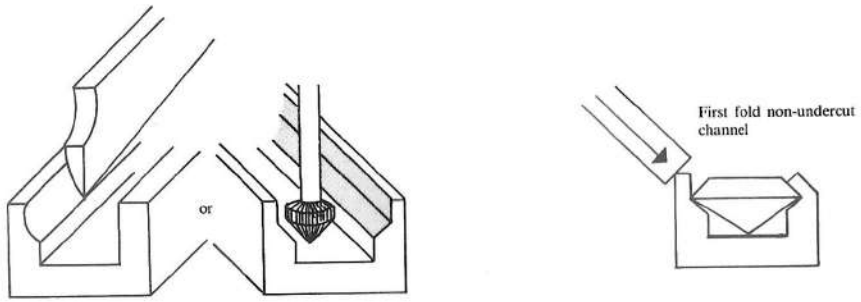
Note: The preferred method of setting square stones (called calibre or carré) in channels is to undercut both sides with a small hart bur. The stones are then friction fitted into the two opposite undercut notches—continuous bearings for square stones, and separate notches for round stones—and tightened. The alternative procedure of cutting one crown bearing vertical require more finishing because the inside of one channel wall is disfigured by the bur and must be bent down over the stones' girdles. By undercutting both sides, the two channel walls can remain upright and need only to be squeezed a bit with a pair of pliers after the stones are snapped into place. What's the disadvantage to undercutting both channels? Snapping the stones into place often contributes to more stone chipping and breakage.

Undercutting is used extensively in channel setting. Whether setting round or square stones in closed or á jour channels, calculate the girdle line carefully then mark it with a steel scriber. Be sure to center the small hart bur directly above any holes and introduce the bur's cutting edge to the girdle line at a relatively steep angle. Once you've undercut the first channel 2/5 of its thickness, whether as a continuous bearing or individually for each stone, cut its opposite notch in the other channel.

As an alternative, a wedge, diamond, or lozenge faced graver is also effective for cutting channel bearings. Make a number of passes with the graver and brace the channel well for a neat, straight bearing.



Sometimes you'll encounter curved channel, such as in a wedding band or cocktail ring. In these cases, small round burs do a quick, accurate job of cutting the ledge or bearing. It's a bit more difficult, but the bearings can also be cut with anglette gravers whose sides have been angled 60° to allow for a neat race or ledge upon which the gemstone girdles rest. Again, think twice before using a seating bur: it's hard to control and both channel walls must be bent over the stones at a rather severe angle.

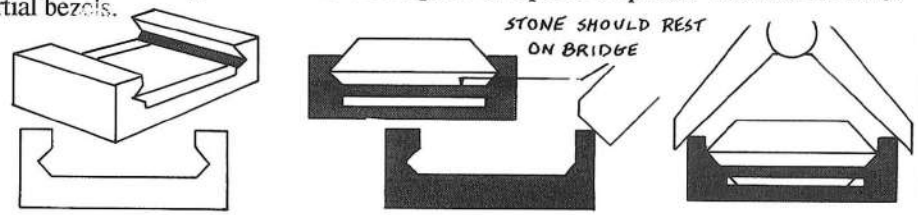


Once you've finished cutting the bearings , touch up any burrs or snags. Insert the stones. Then close the tops and sides of the channel against the stone either with pliers, or a pushing or setting tool.

In many cases, you'll find that a hammer and a small flat ended tool is useful for assuring a tight fit. Hammer gently and try not to mar the metal too much because it will ultimately need to be smoothed and polished.

PREPARING BAGUETTE MOUNTINGS

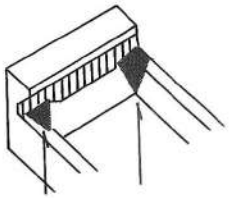
Ready-made settings are available for square or tapered baquettes with either full or partial bezels.



A partial bezel which does not enclose all sides of a stone is the preferred mounting for odd shaped stones, using a combination of bezel and support web to grip the stones firmly.

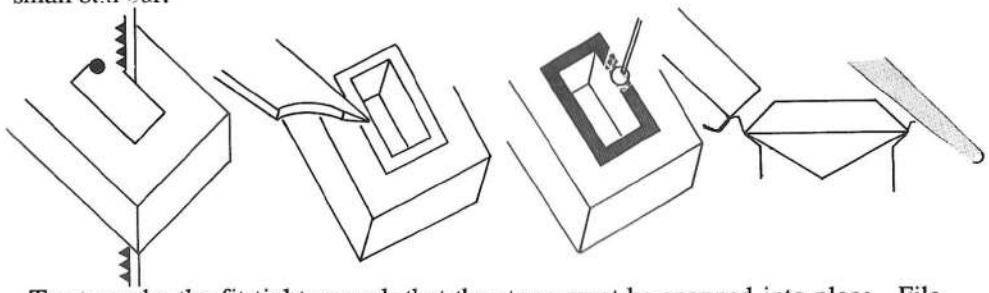
Undercut the bezels with the girdle line located deep enough that the stone's pavilion will brace against the support web. With the stone properly set, the pav- ilion should show a bit above the bridge.

Often you'll also need to file or cut down with an abrasive wheel the edges and corners of the support web so they will fit snugly against the stone's pavilion.



For setting a baguette or an odd shaped stone such as a kite or tapered baguette into

a ring or a section of metal, first drill a small hole through the metal. Into this hole insert a 6/0 saw blade and saw the hole slightly smaller but to the same profile as the stone. Then carefully cut the bearing with an anglette graver or, preferably, with a small ball bur.



Try to make the fit tight enough that the stone must be snapped into place. File away sufficient metal to leave a slight ridge around the stone then use a hammer-piece fitted into a flexshaft, or a hammer and a small flat faced punch and carefully tap the metal ridge over the stone's girdle. Do any necessary trimming up with a flat graver or file.

COVERING SHARP POINTS ON GEMSTONES

The sharp tips on such cuts as pears, marquises, cushions and kite cuts require special attention which if done properly removes the danger of fractures and chips. Any sharp corner on a gemstone must always be given careful attention—including a safety cushion if metal will be brought down over it.

Keep in mind that the metal around sharp tips isn't always meant to grip the stone: often it merely helps keep the stone straight while offering a cosmetic contribution. You don't need to force the metal down so tightly over such tips.

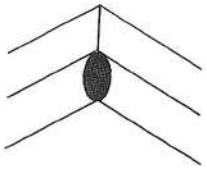
Before proceeding with the work, evaluate the kind of mounting you're dealing with and the type of claw or bezel arrangement. Is there bezel elsewhere or additional prongs—besides what's over a sharp corner—that's intended to grip and hold the stone? If so, these are the elements that will safely accept bending pres- sures by the setter. If not, then the corner prongs or bezel will indeed serve the gripping function.

In the case of prongs, which of the two types of claw—a standard prong or a "V" bezel—are you dealing with? Prongs are pulled back directly over the tip. A "V"

bezel can be folded over the sides immediately adjacent to the tip, thus some of the metal will fold or wrinkle over the tip.

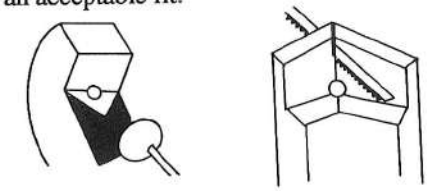
In both cases, you want to eliminate the possibility of any metal pressing directly on or against the tip as you pull down either the prong or the bezel.

First, remove excess metal from the back of the claw beyond what's needed to hold the stone. This step will enable you to bend the prong or the bezel over the tip with only minimum pressure. Second, drill a hole partially through the prong or bezel at the girdle level, making the hole slightly larger than the tip. This hole serves as a safe nesting place for the point during and after the metal has been pulled down.



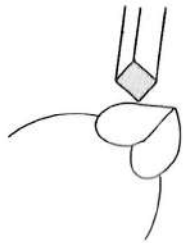
Third, you sometimes may need to clear away excess metal directly below the tip hole to accommodate the pavilion facet edge. Use a round bur, a krause bur, or a lozenge graver to slice a narrow, sufficiently deep trench. Fit the gemstone into

the setting to confirm an acceptable fit.



Finally, the prepared claw can be squeezed or pulled down directly with pliers or forced down with a prong pusher over the tip and later burnished flat to the stone.

The "V" bezels, though, require further work depending on whether you want a split tip or a closed tip. For a split tip, saw with a 6/0 blade from the top of the bezel to the bearing or tip hole. When you squeeze with pliers or push down with a prong pusher, one bezel will overlap the other. This overlap is later removed with a #4 barrette file, filing toward the bottom lip. When is a split V bezel appropriate? Many say only when the V will excessively overlap or if the stone is too large.



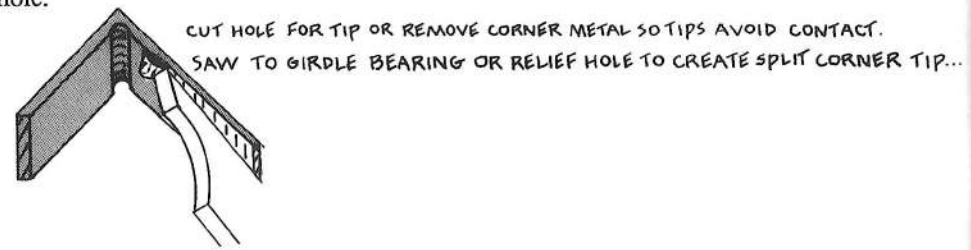
The closed tip can be handled similar to a split tip. Use a pair of snipe nose pliers and squeeze or push over the lips, letting them lap. When you file away the top lip, the short section at the tips will cover the stone tip as a single unit. Smooth the sides and top of the bezel with a pumice wheel, and bright cut or bevel with a polished, flat graver the inside edges of the tips along the crown.

An alternative approach to closed "V" tips is simply to squeeze or pull down the tips, working on the side of the stone only. The metal, of course, will build up

slightly and then wrinkle over the tip area but this is desired. Later when you file away this wrinkled excess, the file's burnishing action will push sufficient metal over the tip area to leave a closed tip. Touch up with a pumice wheel or emery stick, and bright cut the inside corners with a flat polished graver.

Corner Tips on Cushion Cuts

The sharp right angle points on cushion cuts are handled only slightly different from marquise and/or pear tips. Because of the wider angle you face a more serious problem of metal build up, forming a seam at the corners. Therefore in both bezel and prong-set situations, drill a hole for each corner, thin down the back to make the pull down easier, and saw from the top of the prong or bezel to the bearing or tip hole.


CUT HOLE FOR TIP OR REMOVE CORNER METAL SO TIPS AVOID CONTACT.
SAW TO GIRDLE BEARING OR RELIEF HOLE TO CREATE SPLIT CORNER TIP...

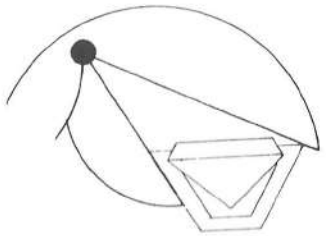
You create, in fact, a split tip when you saw the prongs for a cushion cut. Shape the prong tips with a file or abrasive wheel before pulling down. Use a flat graver to smooth out the rough saw cut.

TURNING DOWN PRONGS

All setters ultimately settle in with a favorite way for turning prongs tips over a gemstone. Despite their first preference, though, they remain proficient in the alternative methods so they can respond to a situation with the technique that conditions warrant. Here is a sampling of prong techniques:

Pull-Down Pliers

The Pull-Down Pliers allow you to come in over the top of the mounting (thus minimizing interference with the mounting itself) to pull the prong tip in such a



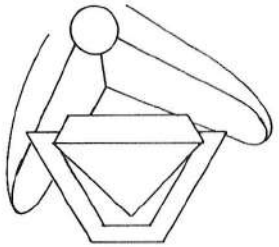
manner that the bending force is offset against the bottom of the cage. This effectively eliminates or minimizes uncontrolled off-setting pressures that can pull the prong over or collapse a mounting case.

The grooved, smooth jaws inflict less surface damage to the metal surface while simultaneously exerting a slip-free grip on the prongs. Adjustable jaws give the added advantage of handling huge stones as well as allowing you to close a prong using the bottom of the cage as a support.

Because the jaws are slightly angled, your pressure control and viewing ease are greatly improved. These benefits can contribute to a smooth, even, controllable squeezing technique that virtually eliminates pressure related incidents.

Snipe Nose Pliers

Regular snipe nose pliers are handy for turning over prongs, usually with the jaws at right angles to the prongs. This gives better control over the pliers, but the problem of offsetting pressure remains and you must be quite careful as you squeeze down the prongs lest the jaws slip or excessive pressure causes a collapse.

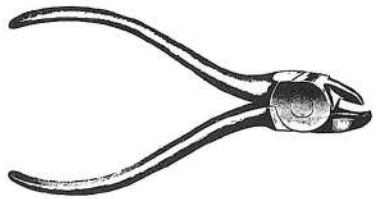


Also, the angle of the snipe nose pliers' jaws are different from the angle of the prongs. Because this sometimes contributes to slippage and marring of the metal surfaces, many setters slip cloth or tape over the jaws to reduce the metal-to-metal condition.

Setting Pliers

Setting pliers are quite proficient for bending tips over. They are made with

parrot jaws, one jaw slightly longer than its mate. This enables you to slip one of the jaws over the prong tip while the other jaw is supported directly below on the bottom of the cage. The pliers work best when a rolling, sliding motion is exerted against the top of a prong while the bottom jaw is held stationary against the cage.



The gooved upper jaw fits the prong tip during this squeezing, sliding motion while the shorter, bottom jaw maintains bending leverage against the tip, forcing it over the stone. These pliers must be used with reasonable care because this bending force can push the stone toward the opposite prong.

Note: Regardless of the type pliers in use, pliers should be used a little at a time...squeeze a litttle, then inspect...squeeze a little, then inspect...etc. Also, prongs should be turned down in pairs. That is, pull one prong down lightly, then turn the mounting around and pull down its opposite slightly. Before finishing off these first two prongs, go to the second set and repeat the process, pulling down the third prong slightly and then again repeating the process for the fourth one.

When all four prongs (assuming a 4-prong mounting) have been snugged down over the stone evenly, then go back and pull the prongs down firmly—again working the prongs down as opposite pairs. This procedure helps avoid pulling one prong down too tightly and cocking the stone in the mounting, or collapsing the mounting case, or causing the stone to be offset to one side in the final setting.

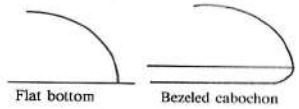
BEZEL SETTING—CABOCHONS

The key to successful bezel setting, especially for cabochons, lies in a snug fit between the stone and the bezel. Unless the fitting is snug, the metal will tend to wrinkle as the bezel is burnished down over the stone. These wrinkles can be removed only by a lot of filing and sanding work—and at the expense of considerable metal removal.

Sometimes the tight fit can be achieved by reducing the stone's girdle.

A wetted diamond stone file comes in handy in these situations for trimming cabochon girdles—and to reduce sharp corners on faceted stones, too.

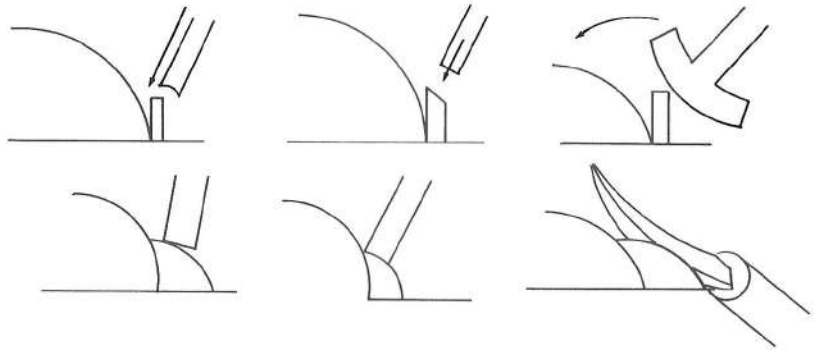
Evaluate carefully the relative heights of the bezel and cabochon or a faceted stone's crown. Also, the lapidary's handling of the cabochon girdle is important.



Many lapidaries finish a cabochon with a flush bottom, making no provision for a girdle. In other cases, the cabochon is finished with a girdle which is either perpendicular to the flat bottom, or has been beveled back slightly.

The proper bezel height is slightly above the girdle. For a cabochon without a girdle, the bezel should reach up just high enough to catch the curvature and thus provide a good grip on the stone. Again, the goal here is to avoid unwanted metal wrinkling or folding.

The above guideline must be modified somewhat when dealing with star or cat's eye cabochons. In order to achieve the sharpest stone or eye, a lapidary must cut the top at about 45° and that necessarily leaves the sides of such stones much steeper than standard cabochon cuts. Consequently, the bezel must remain a bit higher than usual to provide a firm grip—but not too high.



Don't hesitate to use a file to remove excess metal from the back of the bezel so the tapered metal is easier to smooth down over the cabochon. Often the bezels can be quite thick compared to the amount of bending that will be required. Just thin the metal rather than attempt to give it a finished rounded appearance. You'll be pounding on the bezel rather extensively later and will need a flat bezel surface to accommodate the flat face of the punch.

To bring the bezel down over the stone you can use either a burnisher (preferably a rounded type) or a hammer in a flex-shaft handpiece. A flat punch (to make one, file a square tip on the end of a used, annealed beading tool shaft) and a jeweler's hammer can also be used.

When bringing the bezel down over the stone, work in one direction only. After the space between the stone and the bezel has been eliminated, tighten the stone by changing direction on your hammering so you are nearly perpendicular to the top of the bezel. The final step is finishing the bezel to the desired finish and shape.

CLEANING STONES ON THE BENCH

At the bench, gemstones must be cleaned constantly. They either pick up dirt and encrustations from the setter's efforts, or they arrive at the bench dirty. Often, when a stone is removed from an old setting it is encrusted from years of abuse and indifference, a condition that resists easy clean-up.

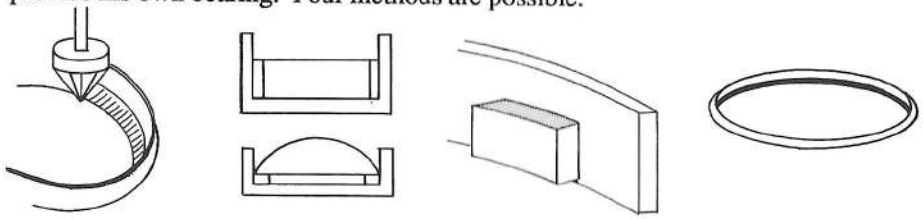
A handy shop aid for quickly cleaning the harder gemstones consists of a supply of ordinary table salt and/or a small rag wetted with alcohol (not denatured because it contains shellac). When you encounter a diamond, ruby or sapphire, spinel, chrysoberyl—or any stone with a Mohs hardness of 8 or more—just place some salt and the stone in the palm of one hand and scrub the stone vigorously with the thumb of the other hand. This is an old diamond cutter's trick—and it works.

The salt, of course, is too soft to scratch the harder stones, but it cleans very efficiently and washes away with no trace. As for the alcohol dampened rag, a quick swipe of the stone over the rag will usually clean away any dirt.

Diamonds and grease have an enormous affinity for each other and colored stones also tend to pick up oil from your hands and from the bench. Therefore ordinary shampoo, especially those brands that are formulated for oily hair, applied with an inexpensive artist's brush and then washed off with water provides a fine cleaner for loose stones—and for finished jewelry as well. Indeed, giving your completed mounting job a quick wash with shampoo and water is an excellent preliminary to an ultrasonic bath (it keeps your cleaning solution from becoming dirty too quickly and minimizes the wait time for a thorough cleaning).

Making Bearings For Bezel Settings

Bezel wire with a flange or ledge upon which the stone can rest is available commercially in a wide variety of styles. Often, though, a stonesetter will need to provide his own bearing. Four methods are possible:



#1—When the metal walls are sufficiently thick, a high speed bur or graver can be used to cut the bearing.
#2—A smaller tube whose outer diameter nearly matches the inner diameter of the setting tube is inserted to the bearing level then soldered in place and sawed to size.
#3—A few snippets of metal are soldered just below the bearing line. Any error should be above the bearing line so a graver or bur can cut away the error for a suitable fit.
#4—A wire or collett is soldered into place at the bearing line.

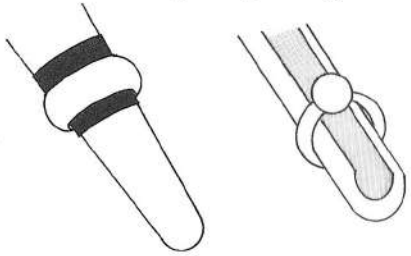
Tapping Down Bezels

Whenever you use a hammerpiece in a flexshaft or a hammer and flat faced punch make certain the mounting is secured against any movement. The worst thing that can happen is to have the workpiece slip so the stone is severely damaged Your attention—and hands—should be on the work, not on keeping the work secure.

The four principle ways to secure work are: 1) engraving block; 2) cement stick; 3) clamps, and 4) mandrels.

Securing a ring, for example, could involve a ring clamp or mandrel or an engraving block. To keep the ring from slipping on the mandrel, slip a section of rubber or emery paper between the ring and the mandrel then pull the shank up snug on the mandrel. Also, get in the habit of locating any stone pavilion directly in the mandrel's groove: the groove is intended to provide a safety space in case a stone protrudes below the mounting case.

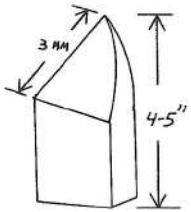
An engraver's block is unquestionably the best tool for securing work—and the most expensive. If you intend doing a lot of work particularly with gravers, give serious thought to the wisdom of investing in a good engraver's block.



The cement stick represents one of the setter's most reliable tools, although you generally do need to handbrace it against the bench pin. For the most part, you need only to warm the workpiece and the cement or wax to a molten state then press the work into the cement. For heat sensitive stones, heat the wax/cement only.

FLAT PUNCH TECHNIQUES

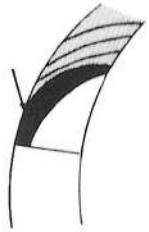
Work the punch on the part of the stone away from yourself, tapping smartly on a near vertical angle to the bezel top while moving constantly in one direction around the stone's perimeter. If you dwell in one place too long with the tool end you'll likely create an unwanted cavity or hollow in the surface...and it will be difficult to correct later.



As mentioned elsewhere, a flat punch whose tip has been filed into a triangular shape then hardened will work effectively for hammering down bezels and rims. The length of the punch should be 4-5 inches with a 2.5-3 mm face shape.

The flat edge of the punch faces the stone, enabling you to move it parallel with the inside bezel rim. So that only a portion of the flat side rests on the metal (to avoid impacting too strongly on the stone), hold the punch at a slight angle and rock it slightly sideways. What makes this kind of flat punch so attractive is its ability to contain the hammering impact to a small section of metal at one time, thus reducing the danger of metal spliting and/or stone breakage. The smaller impact area overcomes springy metal much better, too.

As with any punch operation, move the punch slowly along the rim in one direction, working the metal over the stone girdle a little at a time. You'll need to smooth the metal after circling the stone.



It's best to avoid tipping or angling punches when using traditional rectangular bases. Their flat faces should move flat over the metal, working the metal down section by section with each section being the approximate size of the base of the punch.

In punch use, the process is not so much of pushing metal over the stone but more so of compressing the metal against it. If you consciously attempt to push the metal you could very well run the danger of directing the hammer blows to the stone.

**"When God had
finished painting the
flowers...
...dyeing the birds...
and painting the sunsets,**

**He swept the colors
from his pallet...**

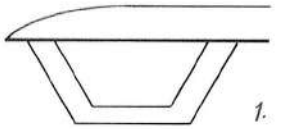
**...and created
the Opal."**

CHAPTER FIVE

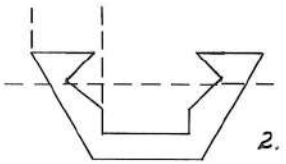
Prong Setting

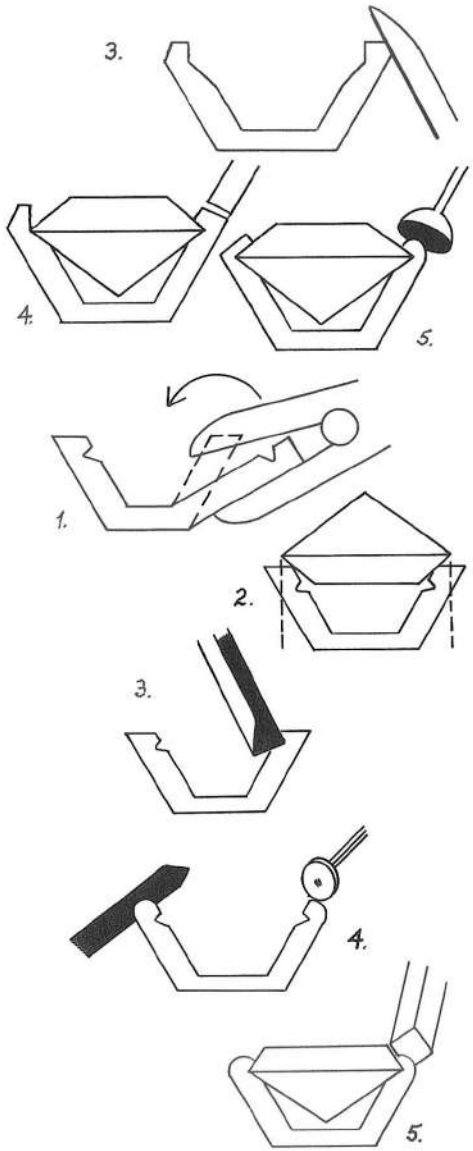
In general terms, the procedure for setting gemstones in prongs consists of five steps:

1. Check prongs for uniform height, angle, and proper size.



2. Cut bearings on same level to 2/5th of prong thickness so stone will seat level when viewed from two directions.





3. Thin the back of the claw if necessary then rough shape the tips to desired configuration

4. Pull down the claws a little at a time, working opposite prongs, with the stone "square-on"

5. Finish the tip shape, smooth and polish.

Pre-Notched Settings

1. Check prongs for uniform height, thickness, angle and then correct any inconsistency.

2. Test stone for fitness in existing bearings.

3. When necessary for improved bearing fit, trim the notches with a 3-cornered file, or a flat graver.

4. Rough in the desired prong tip shape.

5. Place the stone in the setting "square-on" and pull down the tips over the stone's girdle, bringing first prong down slightly then proceeding to its opposite, then to third prong, then its opposite, etc...until the stone is tight.

6. Smooth the claw with #4 barrette file, emery stick or small pumice wheel, then polish.

Standard 4- or 6-Prong Setting

1. Check prongs for uniform height, thickness, and angle.

2. Test stone for fit either on tips or on inside of prongs.

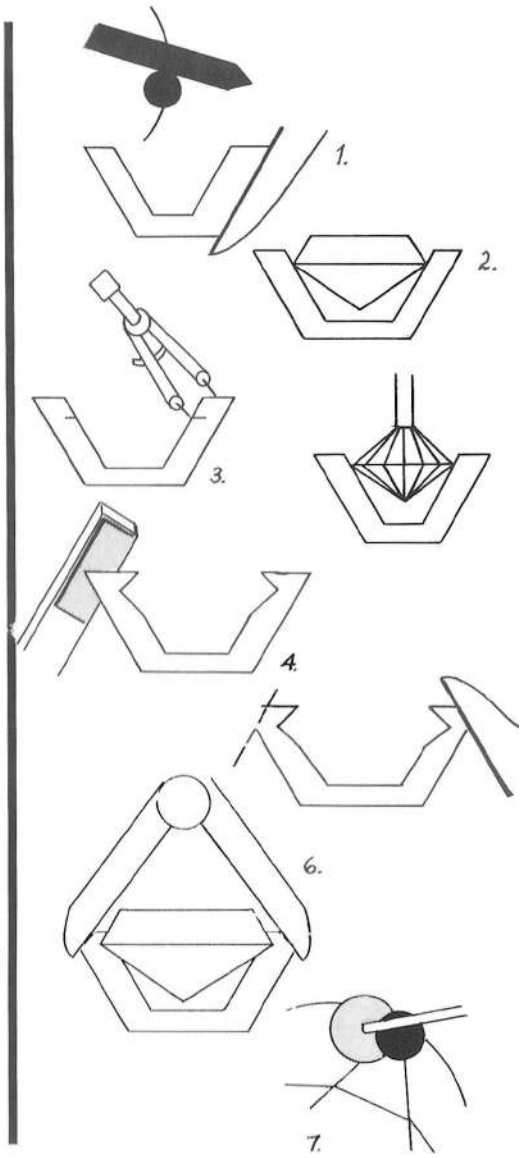
3. Mark the bearing level with dividers, then cut with file, graver, or a bur.

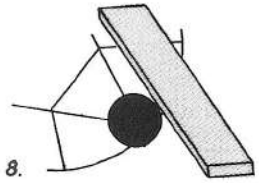
4. Trim burrs or snags with file, graver, or emery stick.

5. If necessary, thin the back of claw to slight taper, then rough shape the prong tips. (See page 87 for proper technique.)

6. Place the stone in bearings "square on" and pull down prongs, working each opposite prong a little at a time until the stone is tight.

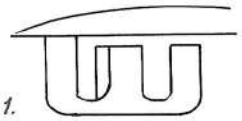
7. Smooth the prongs with #4 barrette file or abrasive wheel, removing any final metal burrs with a flat graver.



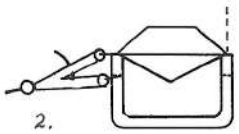


8. Finish with tripoli (final metal smoothing) then rouge (final polish). Except for diamonds or corundum, try to polish across prong tips (at right angle to the stone so the wheel doesn't touch the stone).

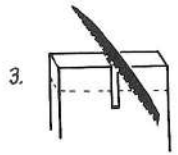
Split Prongs



1. Check prongs for sufficient width for splitting (enough so the prongs can be split and still have attractive looking tips), uniform height, angle, and thickness. If necessary, level prongs with #4 flat file after any metal adjustments (straighten, twist, stretch, etc.)

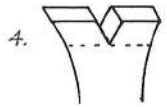


2. Check stone fit then mark the girdle.

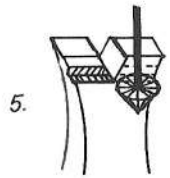


3. Use 6/0 saw blade to split prong to slightly below girdle bearing.

4. Use tiny screwdriver or graver to wedge split tips apart.

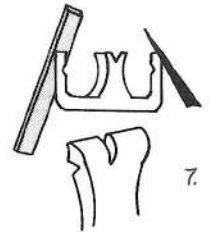


5. Cut bearings on straight line with ball bur (hart bur or oval bur is often good for cutting long bearing races), file, or graver. Bearing line can often be started with 6/0 saw blade, or with 3- or 4-cornered needle file.

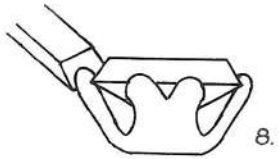


6. Shave off any metal burrs with flat graver and/or emery cloth/stick and smooth out bearings

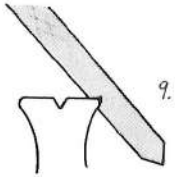
7. Trim and thin backs of claws to promote bending ease, then rough in intended tip shapes.



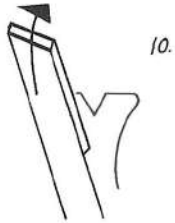
8. Place stone in bearings and use prong pusher or pull down claws with pliers, again using sequence of opposing prongs procedure—but bend both tips on each prong before proceeding to its opposite.



9. Shape the tips, then smooth the metal with a graver, #4 barrette file, emery stick, or pumice wheel.

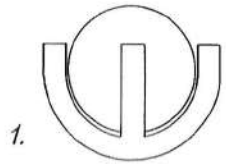


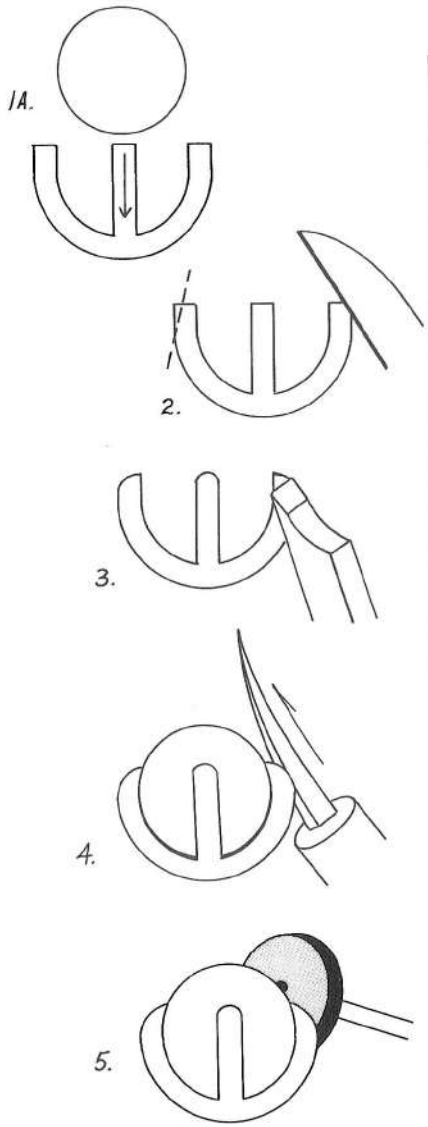
10. Final polish with tripoli and rouge, either using flexshaft or regular polishing machine. Polish in the same direction, so wheel avoids contact with the stone.



Pearl Setting in Prongs

1. Evaluate prongs, and test pearl fit to assure that prongs are long enough to





reach to the upper hemisphere of the pearl.

2. Slightly pre-bend thin prongs so pearl can be snapped into place. On thicker cast or die struck prongs upper portion of prong should usually be thinned on back to promote ease in bending prong to fit pearl's curvature.

3. Remove any metal burrs or snags with a flat graver, #4 needle file, or pumice wheel. Pre-polish the metal.

4. Snap the pearl into pre-bent prongs and burnish until prongs lay perfectly flat against the pearl surface (many setters touch a dab of cyanocrylate, Superglue, to the pearl base). With thicker prongs, burnish down flat with curved burnishing tool.

5. Pearls detest anything liquid or harsh, so polish metal with polishing stick for maximum control—or work carefully with small flexshaft polishing wheel. Don't place the pearl in an ultra sonic or use harsh soaps or chemicals in cleaning: the drier you keep the cleaning operation the better.

Pearl Setting—Peg

1. Evaluate peg height against pearl size, and if peg sits in bowl-like pad make certain the pad can accomodate the pearl snugly.

2. Using tiny drill in flexshaft, waggle drill so that the interior hole is enlarged slightly. Don't enlarge mouth of peg hole.

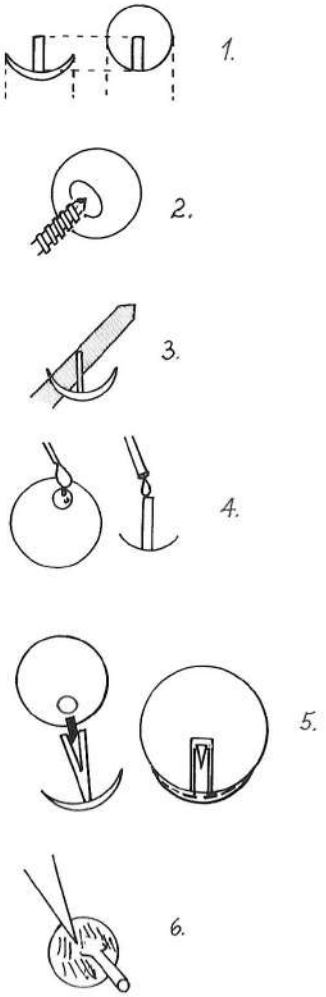
3. With #4 needle file, smooth peg to fit snugly into peg hole mouth. Then use flat graver to split end of peg about 2 mm deep. Make a tiny 1 mm wide wedge about 3 mm long.

4. Place small drop of pearl cement or Superglue into pearl hole using a piece of wire.

5. With wedge loosely between split peg tips, insert peg into pearl hole and press pearl down, forcing wedge to expand peg against inside of pearl hole.

-or-

6. Make sure pearl hole will accomodate peg diameter snugly. If not, use #4 needle file to trim peg, leaving its



surface rough. Rough up cup, too, with graver tip or sciber.

8.

7. Polish the mounting with tripoli and rouge—but not the peg: leave it unpolished.

8. Drop pearl cement or epoxy into pearl hole and into cup.

9.

9. Press pearl down firmly over peg and into cup. (By bending peg slightly, too, it will later act as a clamp under pressure).

-or-

11.

10. If pearl is completely drilled through, check peg to assure length is slightly greater than pearl's diameter.

11. If peg is too short, it can be stretched with pliers or tipped.

12.

12. Adjust pearl hole or prong diameter so prong may be pushed through hole with slight metal tip showing.

13. The projecting end is burnished or spread over with a burnisher or a pointed punch which rivets the peg in place.

14. Smooth the metal tip with a cup bur or a beading tool and then if necessary polish.

Pinpoint Setting

1. With the stone gauge, determine stone's appropriate diameter so it penetrates prongs at least 1/3rd of prongs' thickness when atop the tips (prongs can be bent to accomodate smaller/larger stones, usually 1/3 size maximum difference).

2. Select hart bur or seating bur same size or slightly smaller than stone diameter. A same size bur is more appropriate in this situation because the base plate must be slightly and evenly beveled by bur so stone pavilion will fit snugly. With such burs, the girdle bearings can usually be cut high enough that the stone's pavilion will brace against the edges of the existing opening.

3. Cut bearings with the hart bur, starting at a slight angle and then rotating bur slightly past vertical. With seating

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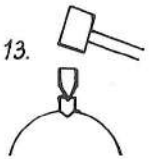

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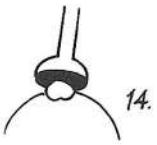

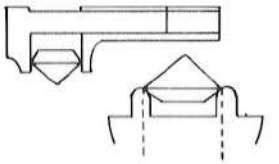

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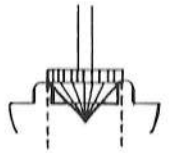

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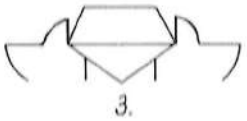

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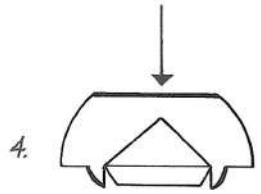
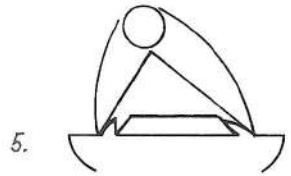
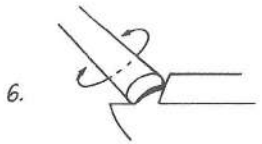
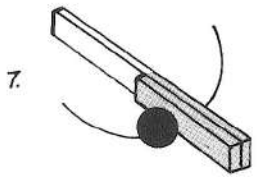








bur, girdle line is usually at the base plate junction with prongs. With stone in bearings, prong tips should extend even or slightly below stone table level so prong tips when finished extend only 1/3 up the crown.

4. Trim rough bearing cuts and burrs with a flat graver or file and test stone for depth, level. Seat diamond using a wood dowel or a fingernail, or by pressing mounting on stone while latter is table down on a flat surface.

5. Pull down pins, following opposing sides sequence, using grooved pliers or grooved prong pusher.

6. Round off the tips with a cup bur (if necessary) or beading tool (pressure from these tools can press tip down more firmly on the stone), maneuvering either tool in circular manner.

7. Touch up any burrs or snags with #4 barrette file, emery stick, graver, or abrasive wheel.

8. Polish, if necessary, with tripoli and rouge.

Pinpoint Cluster Settings

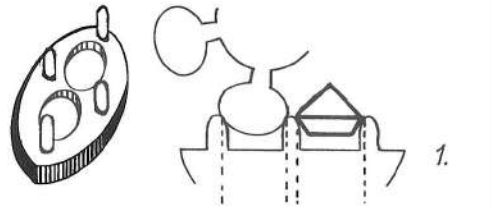
1. Use a stone gauge to confirm the stones will fit properly into the mounting's openings, with stone covering 1/3 of pins' diameters.

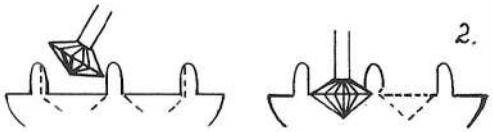
2. Using hart bur same size as stone, tilt the bur so its cutting edge engages main pin close to the base plate, and undercut slightly.

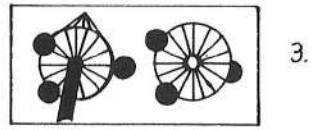
3. Just before bur has cut into pin 1/3rd distance of pin's diameter rotate bur so it cuts vertical line about 2/5 to 1/2 through opposing pin. Stop cutting when handpice is perfectly vertical and bearing is thus cut to same level.

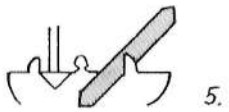
4. Repeat Step #3 cutting procedure for other stones.

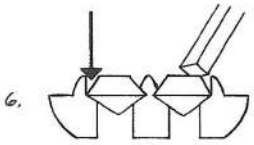
5. Clean up setting of filings and burrs with a #4 barrette file, graver, emery stick or abrasive wheel. Test stones for fit. Mounting holes may need to be routed out slightly with cone or bud bur to accomodate stone's pavilion.

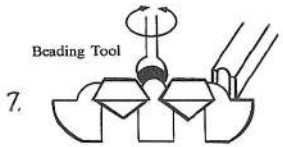


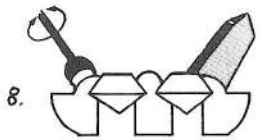


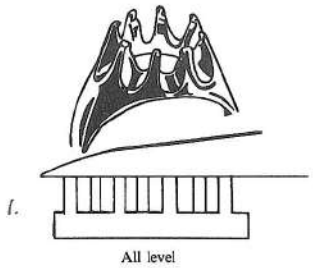


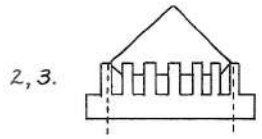


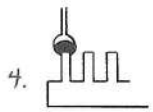












6. Slide stone girdle into undercut posts in center then snap down other side into end pin bearing with fingernail or wooden dowel. Check for uniform stone level on all stones.

7. With all gemstones in place and level, pull down the end pins with pliers or push down with a grooved prong pusher.

8. Shape the tips with a cup bur, beading tool, or fine needle file.

9. Smooth metal and polish with tripoli and rouge.

Multiple Prongs

1. With multiple prong setting, major task is cutting all bearings at precisely same level.

2. Check prongs for uniform height (correct if necessary with #4 flat file), angle, and thickness.

3. Check stone for good fit.

4. Round tips with cup bur then check

mounting again to confirm that tips are still uniform height.

5. With divider, mark girdle bearings on each prong.

6. With small seat bur cut each prong's girdle bearing. A small oval, round or seating bur can also be used, but be wary of a bur whose diameter matches the stone because chatter and vibration problems are accentuated.

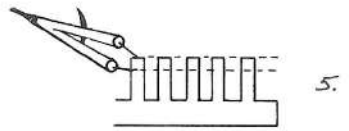
7. Remove any filings or burrs and test stone for fit in each claw.

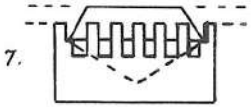
8. Snap stone into mounting and tighten down tips with pliers or prong pusher, using opposing prong procedure.

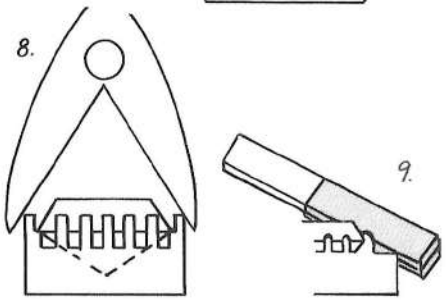
9. Use #4 barrette file, graver, or abrasive wheel for any final smoothing then polish with tripoli and rouge.

Prong Cluster Settings

1. Study the mounting to determine if the stones will be set into their own individual prongs or if some prongs will be used to secure one stone while serving







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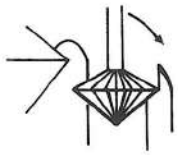
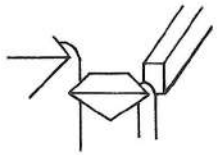




3.

as a brace for another.

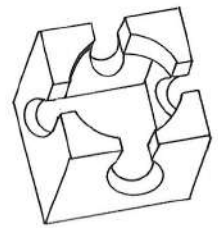
Note: If each stone is mounted in its own prongs you will almost invariably set the small outside stones first, progressing to the larger, center stone. Large center stones tend to obstruct the work of smaller, nearby stones so they're better done last.

2. Check the stone fit and prong uniformity. Evaluate, too, the pattern of prong use...which and how many prongs will be used on the individual stones. Make any metal corrections (straightening, twisting, stretching, filing, etc.)

3. Determine the bearing level. For stones individually mounted, use a small hart bur and cut the bearings to proper depth for all stones for that row and size. For braced stones, the hart bur is preferable for its undercutting advantage. Once the large center stone has been secured in its prongs, it's then best to use a hart bur the same size as the surrounding stones' diameters and first undercut the inside prongs to about 1/3 the prongs' thicknesses. Then rotate the bur to vertical and cut the outside prong. When melee sized stones are involved, you can use a hart bur smaller than the stone and undercut both the back and front prong, snap fitting the stones into place. This latter technique allows you to control the cutting depth easier which is important when dealing with small diameter

Fishtail Mounting

1. Evaluate the mounting carefully for any casting deficiencies—especially prong problems. Make sure the mounting is "squared up," round openings are clean (a split 1/32" shaft with a piece of emery in a flexshaft does this job nicely—and leaves a smooth



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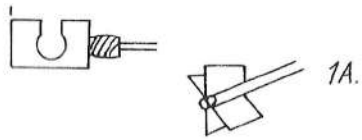

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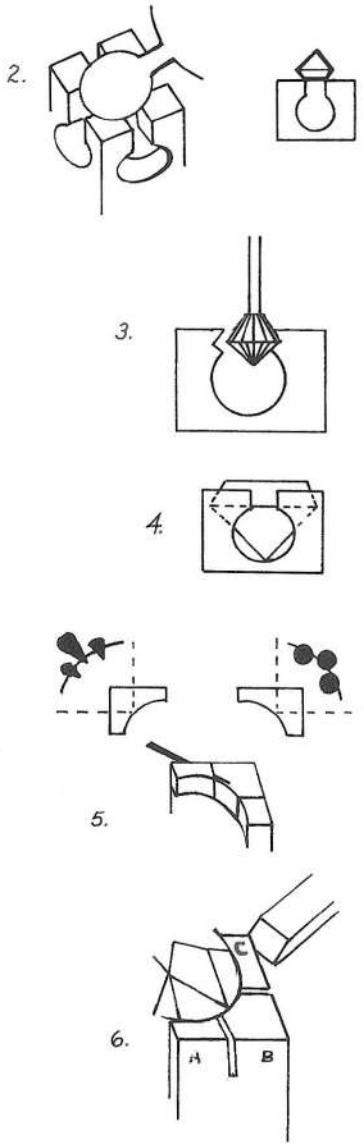


finish too...although a bud bur is often used) and enough workable metal is available.

2. With stone gauge, confirm stone and prong size compatibility. With stone resting upside down on four corners make certain that the stone's girdle extends over all four corners the same distance.

3. With a nart bur smaller than the stone's diameter cut out each corner bearing individually. A proper depth will leave the seated stone's table about parallel with the corner tops.

4. Trim off any metal burrs with a graver and test fit the stone. Any slight variance can be accomodated by bending the corners toward or away from each other.

5. Use a 6/0 saw blade on the corner slots to provide for the prong design motif you want. The standard three-pointed design requires two cuts on each corner, cut to slightly below the girdle bearing. **Caution:** don't try to cut more than one slot at the same time. Angle the blade slightly and cut the slots individually.

6. Use a slotted prong pusher and push "A" and "C" over the stone, then repeat

the process on the opposite side. "B" serves purely a decorative function so the stone will be served by eight claws.

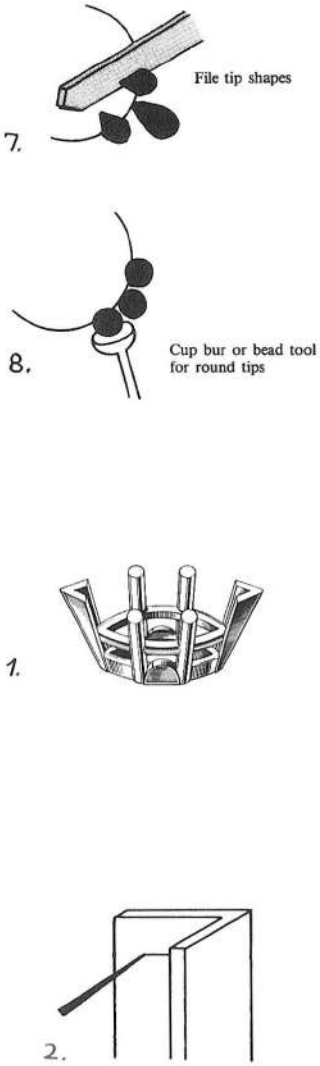
7. Shape the prong tips with a #4 barrette file and/or abrasive wheel. A cup bur or beading tool is useful if the tips are to be rounded.

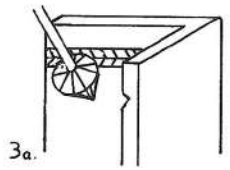
8. If necessary, vector tighten by pushing the prong tips away from the "B" tip with the prong pusher or a flat graver. Trim any snags or burrs away and polish with tripoli and rouge.

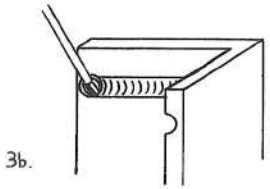
Marquise Setting—"V"Tips

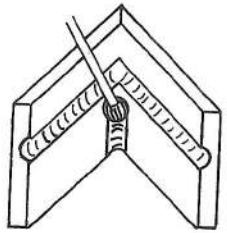
1. Evaluate the mounting for manufacturing deficiencies. Are the "V" prongs straight, same height, thickness, no missing elements or metal globules?) Take particular note of metal thickness (cast mountings tend to be thicker and more brittle) because it will influence your setting approach. With stone seated in bearing the prong tips should be level or slightly lower than stone's table.

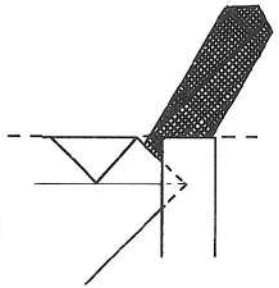
2. Make preliminary stone fit test, realizing that the bearing level must allow the stone's pavilion to rest against

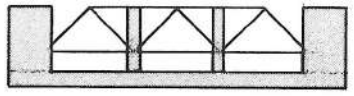












the mounting's bridge for additional security (ideally the cage provides this extra support. In practice it's often hard to achieve so it's better to err on the side of being a bit high: if the tip level is too low obviously you'll need to recut the bearings or file away metal from the inside of the bridge). Mark the girdle bearing level on both side prongs with a steel scriber.

3. Cut all bearings about 2/5th of prong thickness...less for some of the thinner die struck mountings. The bearings can be cut with a hart bur, round bur, of small setting bur (you'll probably need to switch tools to cut the corner), or flat graver. To finish bearing in the corner use a flat graver or small round bur.

4. The metal directly below the corner bearings should be cut away to relieve pressure on the stone's sharp pavilion angle. Use a round or krause bur here.

5. Use a #4 flat file, nippers, or a 6/0 saw blade to trim V prong tips to proper height—level with or slightly below the stone's table.

6. Test stone fit in bearing. Side prongs generally bear stone gripping function

and these should be cut carefully to assure same level as corner tip bearings.

7. Use a flat graver to smooth out the bearings. Remove any burrs, etc. If metal appears too thin to drill tip pressure relieve hole, bend both V prongs back slightly with pliers so stone tip doesn't touch metal.

To Make a Split V Tip...

8. To make a split V tip, use a 6/0 saw blade to cut the corner down to the tip hole.

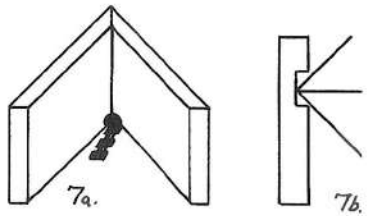
9. With the stone properly seated, use pliers or a prong plusher to fold down one lip flat, then overlap the other one.

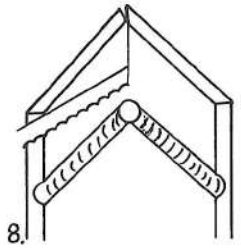
10. Use a #4 file, filing the top lip toward the bottom lip until both are even. Finish trim the edges neatly with a flat graver, then smooth and polish.

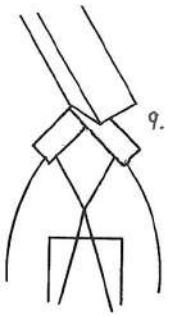
To Make a Closed Tip...

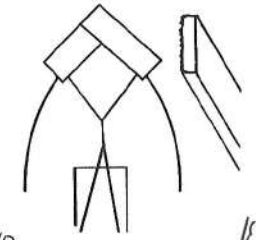
11. With a 6/0 saw blade, saw the corner down to within 1/3 of the tip hole. Fold the lips over the same as if making a split tip and use a #4 hand file, filing toward the bottom lip until both lips are even. Trim the tip edges with a polished flat graver then smooth and polish.

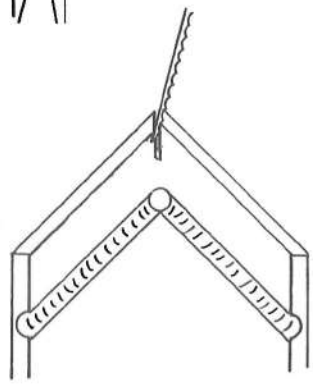
-or-

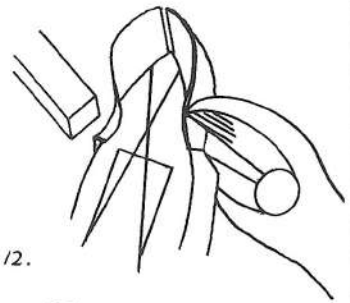


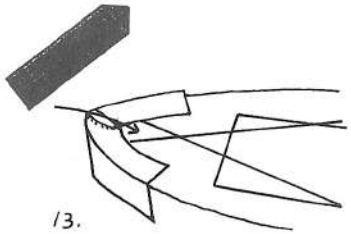


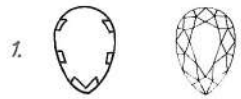


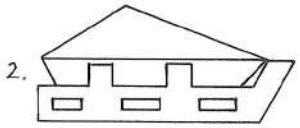












12. With the stone seated properly in the bearing, use pliers or a prong pusher to force the lips down evenly on both sides, working from the inside edge toward the corner. This will cause the metal to wrinkle at the tip.

13. With a #4 hand file, smooth down the prong tips, working from the tip toward the center of the stone. The filing action will remove and burnish the metal over the tip.

14. Trim the prong edges with a flat, polished graver, then smooth and polish.

Heart/Pear Setting—"V" Prong With Support Prongs

Most heart/pear as well as marquise mountings feature two or more support sprongs for the stone's rounded edges so the techniques described here also apply to these other shapes.

1. Evaluate the mounting for prong uniformity (height, thickness, straightness, etc.). "V" and support prongs should all be the same height initially.

2. Test the stone for proper fit. With stone upside down, stone girdle should

cover 1/3 of support prong thickness while stone tip barely touches inside corner...and pavilion should ideally rest on support web. Make adjustments with pliers and #4 flat file.

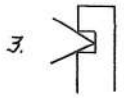
3. Mark the girdle bearing with a steel scriber. Mark the stone tip relief hole also if you intend to drill one...then drill hole before working on corner bearing.

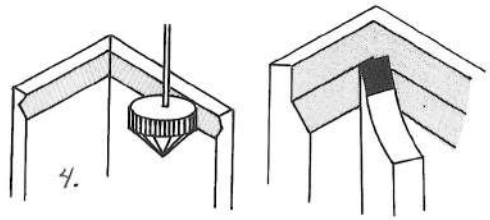
4. Cut the bearings with a hart, round or seating bur, file or graver. Most of the inside corner of a "V" prong can be done with a hart or round bur then finished out with a flat graver.

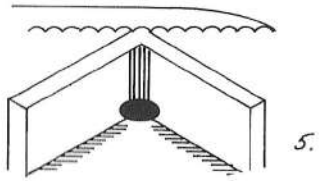
5. Prepare the "V" prong for split or closed tip. For a split tip, saw with a 6/0 blade to the tip relief hole. For a closed tip, saw to within 1/3 of hole. If necessary, taper the back of the "V" lips so they'll turn down easier.

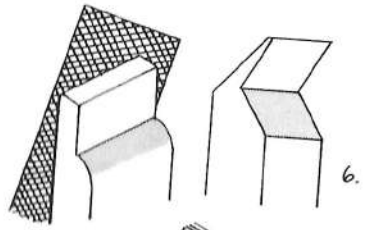
6. Cut bearings then taper the back of the side support prongs. Shape their tips.

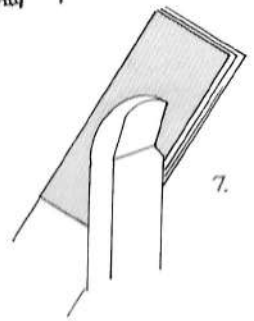
7. Trim off burrs or snags with #4 needle file, emery stick, or flat graver.

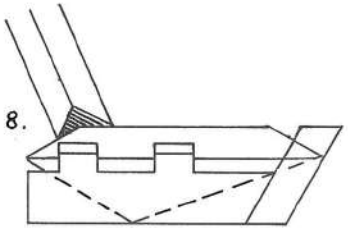




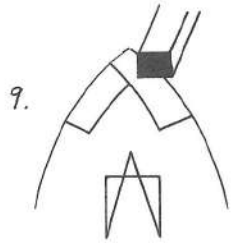


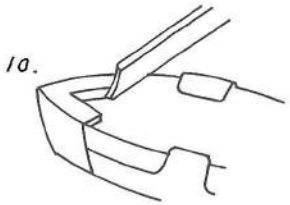






Pull down side support prongs first. V tip is last.





8. Place the stone in the mounting with the tip in the relief hole or away from contact with corner metal. First, pull down any side support claws with pliers or prong pusher to secure the stone in a level position...then use prong pusher or pliers to fold down the "V" prong lips (don't tighten the "V" prongs yet).

9. Carefully, so as not to tip the stone, overlap the "V" prong lips. File the top lip toward the bottom lip if corner(s) has been sawed. Otherwise squeeze down the front edge of the lips, working back toward the tip so the metal will wrinkle...then file toward the center of stone until the "V" prong is smooth.

10. Trim burrs, etc. with a flat graver, emery stick, or abrasive wheel, then polish with tripoli and rouge.

Marquise or Heart/Pear Settings—Single End Prongs

For setting purposes, a marquise or pear/heart setting with a single prong to accomodate the sharp tip doesn't differ all that much from the "V" prong mounting with one exception: a pressure relief hole in the prong is required because the prong tip must be worked back over the stone girdle.

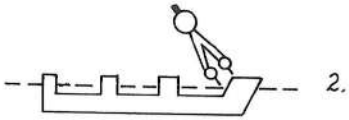
1. Study the mounting for any deficiency (prong height uniformity, thickness, straightness). Test the stone for proper fit either on top of the prongs or on inside.

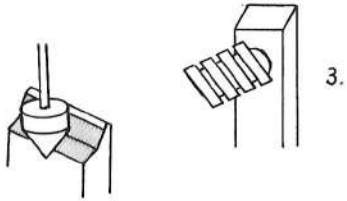
2. Mark the bearing line with dividers. Pay careful attention wherever prongs are directly opposite such as a marquise setting, or a pear setting with the tip prong opposed by a rounded edge prong. In these cases, cut other support prongs' bearings and then re-check—with the stone in the mounting—to assure that the tip holes/bearings will all be at uniform levels.

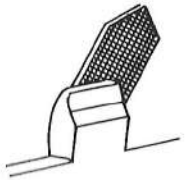
3. Cut the support claws with a hart or seating bur, or needle file. Confirm the tip level, then drill a relief hole and cut the tip prong bearing.

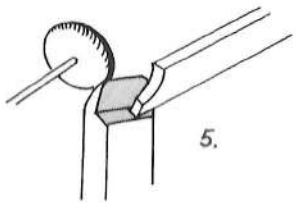
4. Do any preliminary shaping of prong tips.

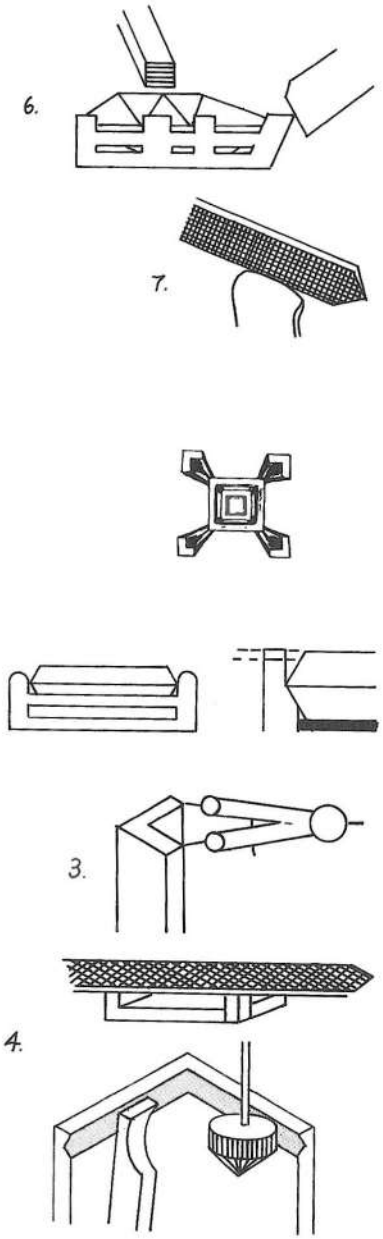
5. Trim away the burrs and jagged edges with a flat graver, emery stick or pumice wheel.











6. Test stone fit in bearings. Adjust any variance with pliers. Then pull down the tip claws with pliers or a prong pusher lightly. Pull down the support claws then tighten all prongs a little at a time until the task is completed.

7. Trim burrs or snags with a #4 barrette file, emery stick, or abrasive wheel. Smooth and polish.

Cushion Setting—Split Prongs

1. Study the mounting and prongs for uniformity (height, thickness, angle, etc.) Correct deficiencies.

2. Check stone fit. You want the pavilion to rest, if possible, on the support web so the size check should be made on the inside of the corner prongs.

3. Mark the bearing levels with dividers or a steel scriber.

4. File the corner prong tips down even with each other, using a #4 flat file so the tips will be about on level with the seated stone's table. Cut the bearings with a hart, round or seating bur. Extend the bearing into the sharp corners with a ball bur or flat graver.

5. Plan to have the stone's sharp tips away from contact with the bearings when the claws are turned down.

6. With a 6/0 saw blade, cut the inside corner down to the girdle line. Use a #6 needle file to shape the eight corner tips, and perhaps taper the backs of the claws to promote ease of turning down.

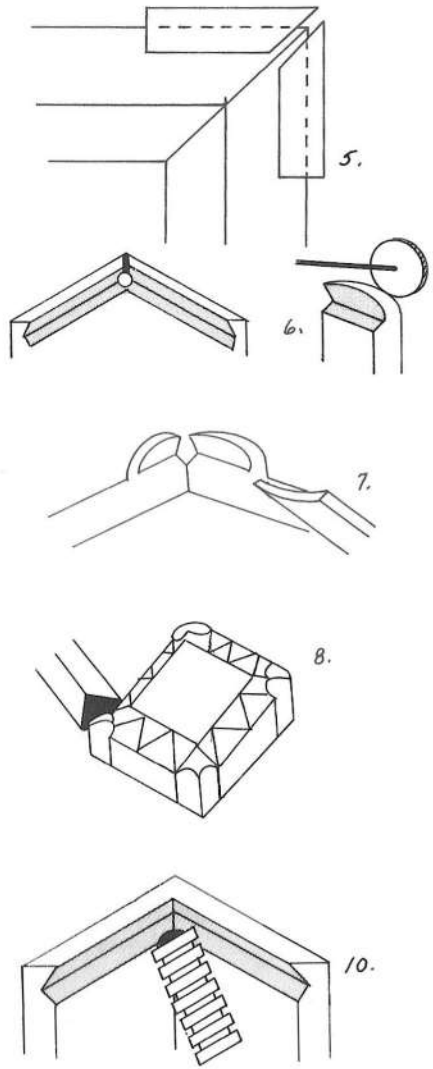
7. Use a flat graver to remove jagged edges, burrs, and then brush the mounting clean.

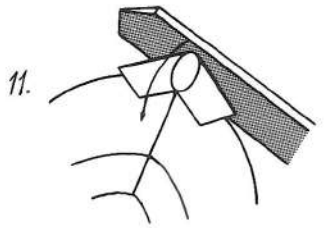
8. Place the stone in the bearings and turn down the prongs, working diagonal corners, with a flat prong pusher or pliers.

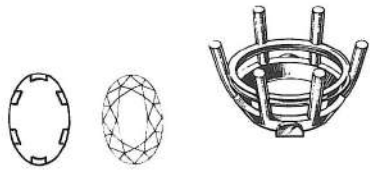
9. Smooth the metal with a #4 needle file or emery stick, then polish with tripoli and rouge.

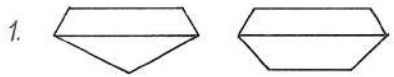
-or-

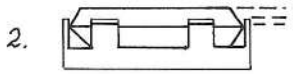
10. To provide non-split corners for a cushion cut, follow steps 1 thru 5 but cut a partial tip relief hole in each corner. Then place stone in bearings, and with a pair of pliers turn the lips down,

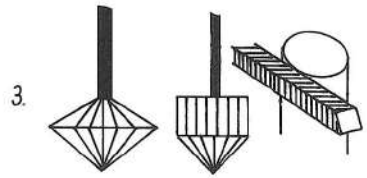


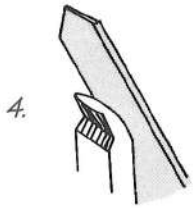












working toward the corner so the wrinkle will occur at the corners.

11. Use a #4 flat file and file toward the center of the stone so the filing action will remove metal while burnishing the lips down flat over the stone's corners. Trim the metal and edges with a flat, polished graver then polish with tripoli and rouge.

Oval Mounting—Prongs

1. Check the mounting for uniformity (prong height, thickness, straightness, etc.) Correct variances with a #4 flat file and/or pliers.

2. Check the stone fit on top of the prongs or on the inside. Mark the bearing line with dividers or a steel scriber.

3. Cut the bearings with a small hart bur, or a 3- or 4-cornered file.

4. Taper the backs of the claws for ease in turning down, then shape the tips.

5. Because few oval mountings have directly opposing prongs, it's usually best to turn down tips with a prong pusher or by bracing the pliers against

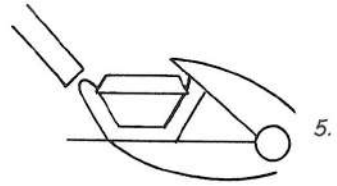
the bottom of the cage and squeeze-pushing the tip over and down onto the stone. Keep in mind, too, that the girdle curvature of an oval cut stone obligates a setter who wants a tight fit to either twist a prong slightly or slant the bearing notch slightly so the bearings will conform to this curvature.

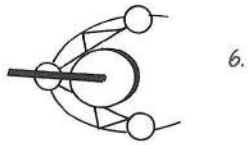
6. Smooth the metal with a #4 barrette file, emery stick, or abrasive wheel. Polish with tripoli and rouge.

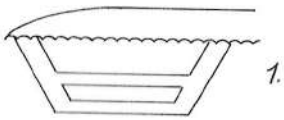
Octogon Mounting—Prongs

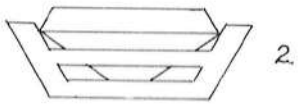
1. Check the mounting for uniformity (prong height, thickness, straightness, angle, etc.) Correct any variances with a #4 flat file and/or pliers.

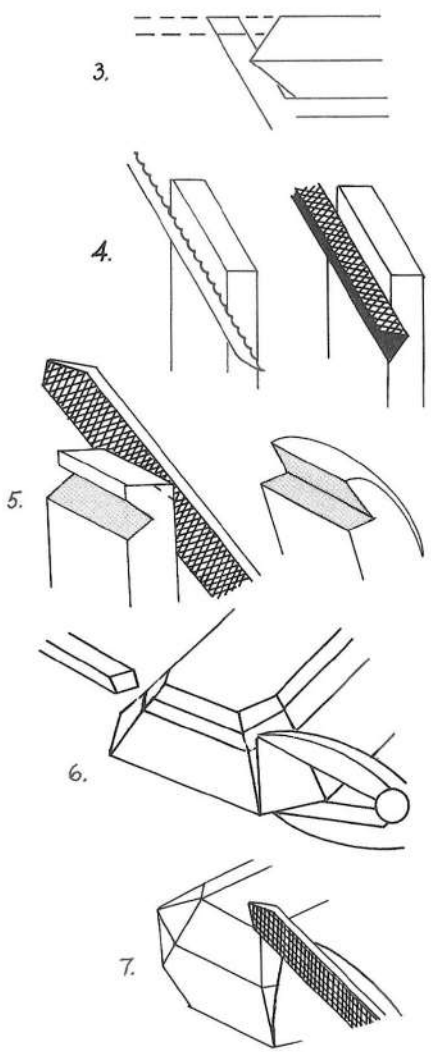
2. Check the stone fit. Octogon settings generally have angled prongs because of the truncated corners so the measurement is best done on the inside of the prongs. Think twice before setting an octogon stone of any size in a mounting that doesn't have a bridge or support web. It's this part of the











mounting that should be in contact with the stone to prevent lateral movement.

3. Mark the girdle line with a divider or steel scriber at a level that will assure contact betweeen the stone's pavilion and the bridge. The prong tips should be at a level slightly lower than the top of the stone.

4. Cut the bearings with a 3- or 4-cornered needle file, a hart, round, or seating bur, or a flat graver. If the prongs are quite wide, notching the girdle line with a 6/0 saw blade insures a straight bearing line.

5. Use a #4 needle file to shape the prong tips. Taper the back of the claws to promote ease in turning down, then trim off burrs and snags with a flat graver, emery stick or abrasive wheel.

6. Place the stone in the bearings and push down the prongs with a flat prong pusher, or brace the lower jaw of pliers against the bottom of the cage and squeeze-push the tips over the stone's girdle.

7. Finish up smoothing the metal on the claws with a #4 barrette file, emery stick or abrasive wheel. If desired, bevel the tip edges with a flat, polished graver. Polish with tripoli and rouge.

Reverse Cabochon Set—Prongs

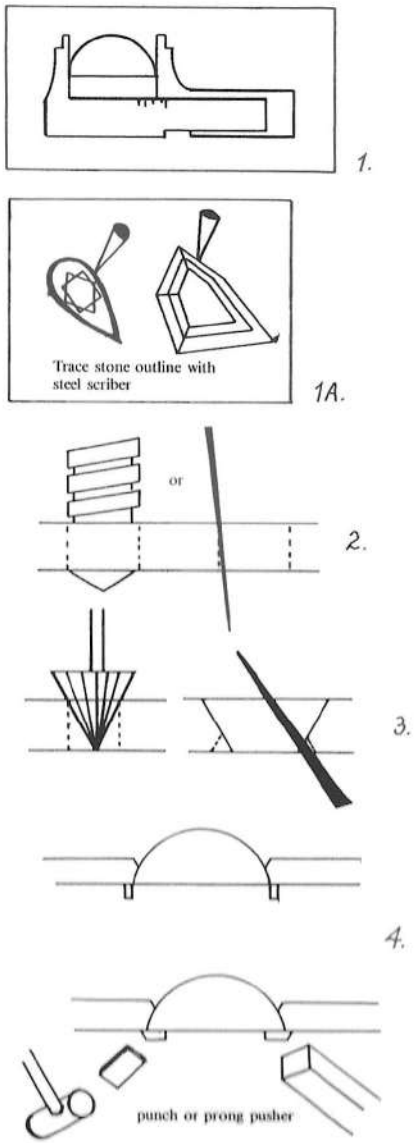
Because the prongs will be on the bottom of the mounting, the key to this cabochon setting method is in the angle fit between the metal plate and the stone.

1. Measure the stone's configuration accurately then transfer these measurements to the metal.

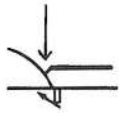
2. Drill a piercing hole then cut out the hole slightly smaller than the silhouette of the stone with a 6/0 saw blade.

3. Using a #4 round needle file, file from the back a slight angle on the hole edges—closely matching the slope of the cabochon. Keep test fitting the stone to assure that the metal fits closely and the bottom of the cabochon ends up flush with the bottom of the metal.

4. Place the stone in the opening then use a prong pusher to turn the prongs over the bottom of the cabochon. Burnish the prongs down tightly. The prongs should be on the extreme edge of the hole and may need to be turned back slightly to allow the stone to be inserted.



5. Check the fit of the top metal surface and stone for presence of gaps. If the fit is not absolutely precise gaps will exist and you will need to burnish down the edges to get a tight fit (use a triangular punch)



5.

-added option-

With a flat, polished graver, bevel the leading edge of the metal at a slight angle. Remove any residual rough metal then smooth and polish.

CHAPTER SIX

Bead Setting Techniques

Bead setting need not be the difficult kind of diamond and stone setting method as it is sometimes portrayed. It certainly requires a considerable amount of practice before a professional level of proficiency is developed, but the fundamentals are rather straight forward and simple in performance.

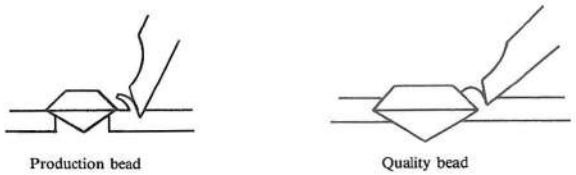
Much of the early concern felt toward bead setting is psychological. It's easier to face a mounting where the metal has already been provided and subsequent steps are indicated. A flat piece of metal represents a different kind of challenge: the setter makes all the decisions.

First, as noted earlier, it is important to remember that in most instances the phrase "bead raising"" is a misnomer. About the only time a bead is truly *raised* occurs in production setting, a fast operation intended to set diamonds and colored stones in the swiftest manner possible—usually with minimum security for the stone. In the remainder of cases, beads are actually produced by forming a small spur of metal *down and over* the girdle of the stone. When excess metal is removed from around the spur which is then rounded with a beading tool, the bead takes on the appearance of being raised.

The difference between quality bead setting and production bead setting lies primarily in the attitude toward the bearing hole and the creation of the metal spur. In production setting, the hole which is routed out remains slightly smaller than the stone. The stone is then placed in this opening with the girdle resting on the metal

surface. Metal slivers are scooped up by the graver so no metal needs to be cleaned away for the bead effect.

In quality setting, of course, a bearing is cut out in the routed hole so the girdle may seat lower than the top surface of the metal. In this way, the spur is forced down and over the girdle and then the surplus surface metal cut away.

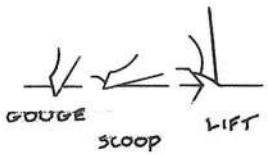


Production bead

Quality bead

Obviously, in production setting the security is not great because only the beaded slivers hold the stone and if one or more of these beads is broken off the stone is lost. With a quality bead setting, the stone is fitted or seated in the metal and the beads provide added security.

As you proceed with your bead setting keep the above firmly in mind. Unless you are doing production setting, realize that the success of a flat setting depends primarily on how well the stone is seated in its bearing.



At the same time, "raising" a bead can be more easily performed if you develop a graver technique that is a variation encompassing the "scooping" action of the production setter. This means introducing the graver at a rather shallow angle about 1 mm back and then pushing toward the bearing hole so that the face of the

graver gouges progressively deeper and "scoops" up a metal spur as it approaches the stone. The graver is also gradually rotated to a steeper angle during this forward movement until the graver action is halted just short of the bearing where it is brought up nearly vertical, thus piling the metal over and onto the stone girdle.

The finishing of the bead is generally accomplished with a beading tool which both tightens and forms the bead.

The above "scooping" technique applies with mountings that offer sufficient metal area to work. It would obviously be impractical in the case, say, of pavé setting where the graver tip must be introduced very close to the stone girdle in an almost vertical mode. The graver is then pushed downward, wedging a metal spur down onto the stone girdle.

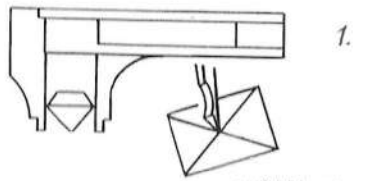
For stones larger than one carat, the "A" technique as described in Chapter Four is often preferred, although the "scooping" technique is still valid because of its ability to build up a rather substantial sized metal spur.

Regardless of your preferred method, practice on brass or copper plates until you form a technique that you're comfortable with—and which does the best job for you.

Flat Top/Carré Type Setting

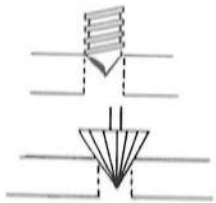
1. Use a stone gauge to determine stone size, then mark the stone center with a graver nick or center punch.

2. Drill a hole smaller than the stone's diameter at the punched center mark, drilling completely through the metal. For a larger hole, it's easier to drill a small hole then route out with a bud or cone bur to about 3/4 size of the stone.



1.

mark/nick center



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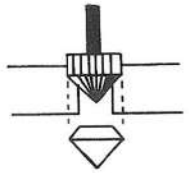

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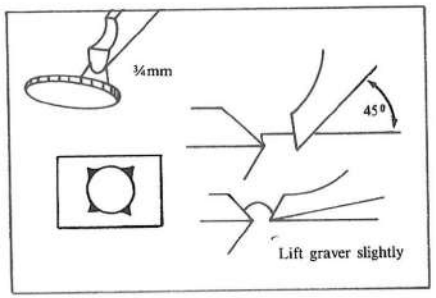


5.

3. With a seating bur the same size—or slightly smaller—than the stone, grind a seat or bearing in the hole. The side cut of the graver should cut to a depth where the metal surface is slightly higher than half the stone's girdle.

4. Test fit the stone in the bearing to confirm that the girdle will sit level and slightly below the metal's surface.

5. With a round graver start a "scooping" cut about 1 mm behind the stone girdle. Raise four beads opposite each other.

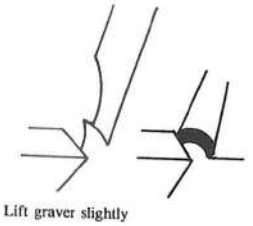
Note: Some setters leave the stone out of the bearing while making these initial bead cuts. If you prefer the stone in place during this phase, snap fit it into the crown bearings. It may require a bit of pressure and/or additional graver action. Don't attempt on the first cut to finish each bead or turn it over the stone. When the spur begins to cave in over the stone, stop and proceed to the next bead, working opposite beads. When all four spurs have been raised then return to each one and resume pressure while rotating the graver face to a steeper angle which forces the metal down over the stone.

A touch of superglue serves nicely to hold the stones firmly in the bearings while you're raising beads . Afterwards, a soak in Acetone will remove all traces of the glue (using glue involves artistic pride—but it does work!)

6. To bright cut around the beads, start by cutting with a knife graver a line from each outside corner to the back of the bead. The line should be quite shallow at the corner and then become progressively deeper as it approaches the bead—but never deeper than the stone's girdle and/or the base of the bead.

7. Starting halfway between beads with a flat graver, remove surplus metal using short, shallow strokes so that the sides taper down from the edges to the stone girdle level. Keep the graver bottom polished, and finish with strokes as long and as smooth as possible.

8. With an appropriate sized beading tool, round and finish each bead, further burnishing each bead firmly over the stone girdle.



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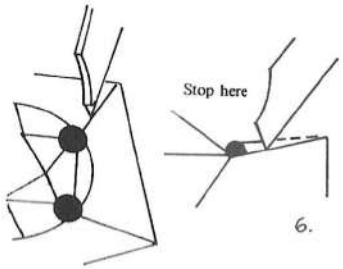

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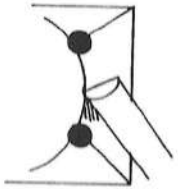

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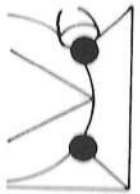

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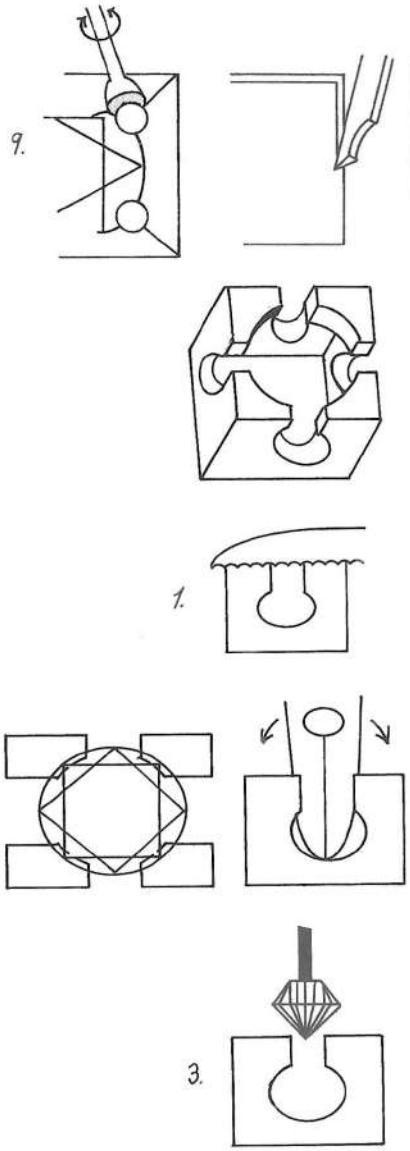


9. Use a knife-edged graver to engrave a line parallel with the outer edge so the milgraining wheel will have a track to run in. Then milgrain the outer edges of the mounting. Where the milgraining tool won't reach adequately, use a hammer and tiny beading tool to simulate bead impressions.

Fishtail Setting

The corner prongs on a commercial fishtail setting can be finished in a variety of styles. These variations were covered earlier. The favored style is the bead set motif described here:

1. Study the mounting for any manufacturing deficiencies (metal globules, filled in openings, uniformly squared corners, clean edges, etc.)

2. Test the stone fit by placing it atop the mounting. The stone girdle should overlap each corner post slightly (the corners can be tilted slightly to accomodate small differences in stone sizes).

3. With a hart burt smaller than the stone diameter, cut the bearings so the tops of the mounting are more than half

the crown height.

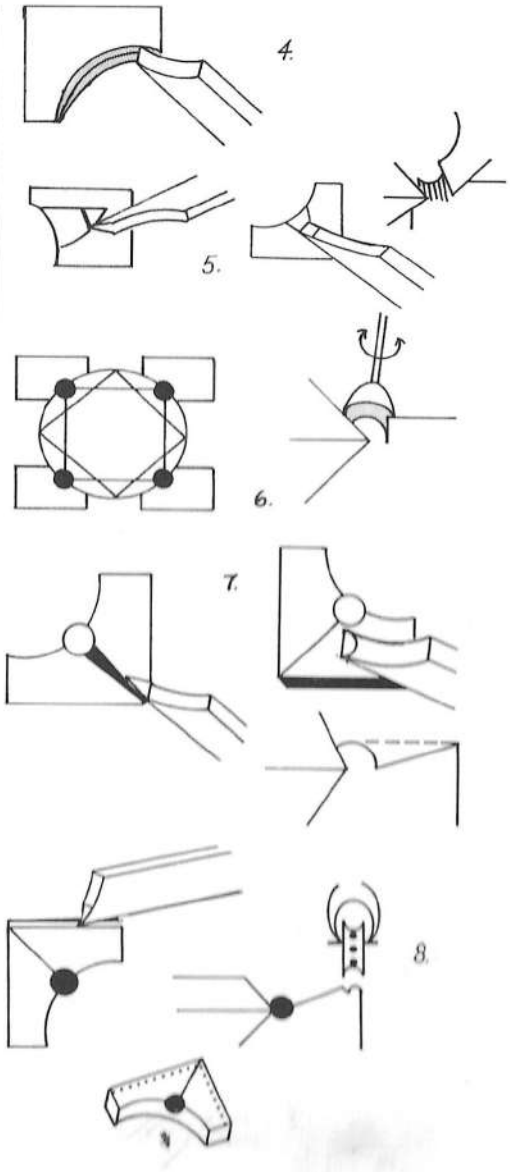
4. Test stone for fit. Remove burrs or jagged metal edges.

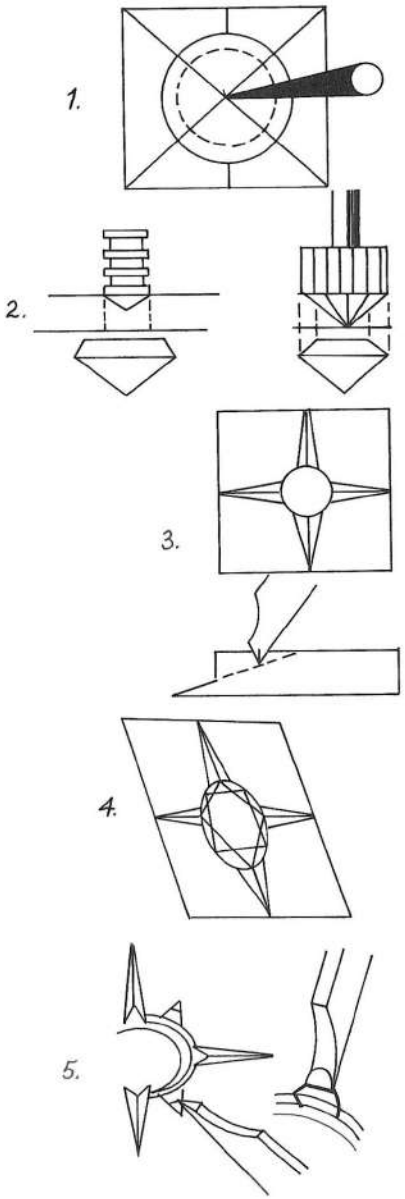
5. With the stone out of the bearing, raise beads with a round graver using the "scoop" or "A" method, halting the graver action as soon as the metal spur starts spilling into the bearing.

6. Snap the stone into the bearing and with the round graver finish wedging the metal over the girdle. Use a beading tool to round and tighten the beads firmly over the stone.

7. Cut a sloping knife-edged line with the graver from each corner to the back of each bead. Trim away surplus metal with a polished flat graver, using short, shallow strokes directed toward the corner lines. Cut no deeper than the stone's girdle.

8. With knife-edged graver, cut the line parallel to the outer square edges so the milgraining tool will have a track. Then milgrain all four sides.





STAR SETTING

1. Check the stone size with a stone gauge then mark the stone center with a scriber, graver tip, or punch.

2. Drill the stone hole then route it out to 3/4 size with a bud or cone bur, or drill a larger hole and cut the bearing with a seating bur the same size or slightly smaller than the stone diameter.

3. With a wedge or square graver, start well back from the bearing hole and cut at least four opposite and sloping triangular tracks down to girdle line depth. You can use a scriber or knife edged graver to start or mark each track, then increase pressure on the wedge shaped graver as you approach the hole in order to cut a progressively deeper channel. You may also want to go over each channel more than once with a anglette graver in order to improve the widening sides in each track.

4. Test the stone for fit. Remove snags or burrs with a flat graver, emery stick, or pumice wheel.

5. Use a knife-edged graver to cut an "A" between each star rays and raise the beads with a round graver—or use the "scoop" technique.

6. Replace the stone in the bearing and finish turning down the bead spurs. Round the spurs with a bead tool, burnishing the metal down tight over the stone girdle

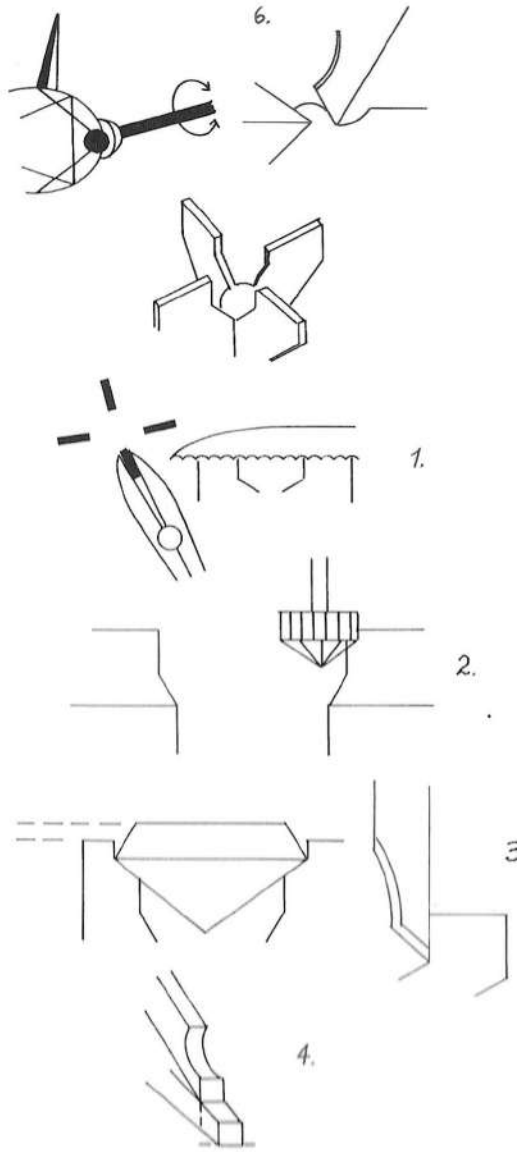
Bar Setting

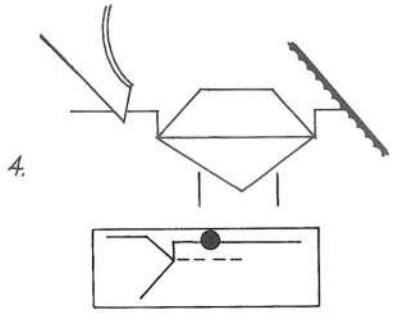
1. Check the mounting for uniformity (prong height, thickness, straightness, etc.) and proper size for stone.

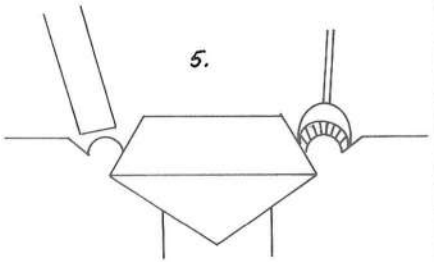
2. For small stones (.50 carat and smaller) it's preferable to use a hart bur although a seating bur can be used to cut the prongs. For larger stones, it's best to use a smaller hart bur and cut out each bearing separately. Bearing depth should be such that with the stone in the seat the top surface of the prong is slightly less than the stone table level.

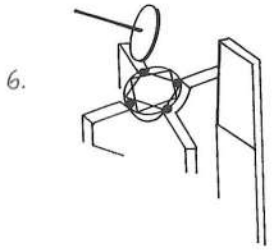
3. Test the stone for fit. Remove any burrs or snags from the bearing with a flat graver, emery stick or abrasive wheel.

4. Place the stone in the bearing "square on." For small stones use a #42 flat graver to raise a prong. On larger stones—and if you have room to









work—you can use a 6/0 saw blade or rat tail file for the same purpose. With either method you choose, cut down just short of the girdle level, starting back from the bearing hole about the same distance or slightly less: thus the metal bead section you'll be working with will be almost square.

Note: Use the flat graver (flat gravers are preferred over round gravers in bar-top setting work because the former have a safer cutting edge and are less apt to slip off the thin or rounded prong edges). The graver action is one of prying the square bead over the stone edge.

5. Hammer or burnish with a beading tool to bring the prong down flat and firm over the stone. Use the beading tool, file, or abrasive wheel to shape the bead prong.

6. Remove any rough metal with a #4 barrette file, emery stick or abrasive wheel then polish with tripoli and rouge.

"Star" Type Setting

The approach to setting a stone in a "star" type mounting is similar to the bar-top technique except that the tips are finished as extensions of the flat prong surface.

Because of this severe design requirement your major challenge becomes one of maintaining parallelism between the four prong surfaces and the stone table. Even the slightest deviation will be noticeable.

1. Check the mounting for uniformity (prong tops parallel, same thickness, straight, etc.) Correct any lack of parallelism with a #4 flat file.

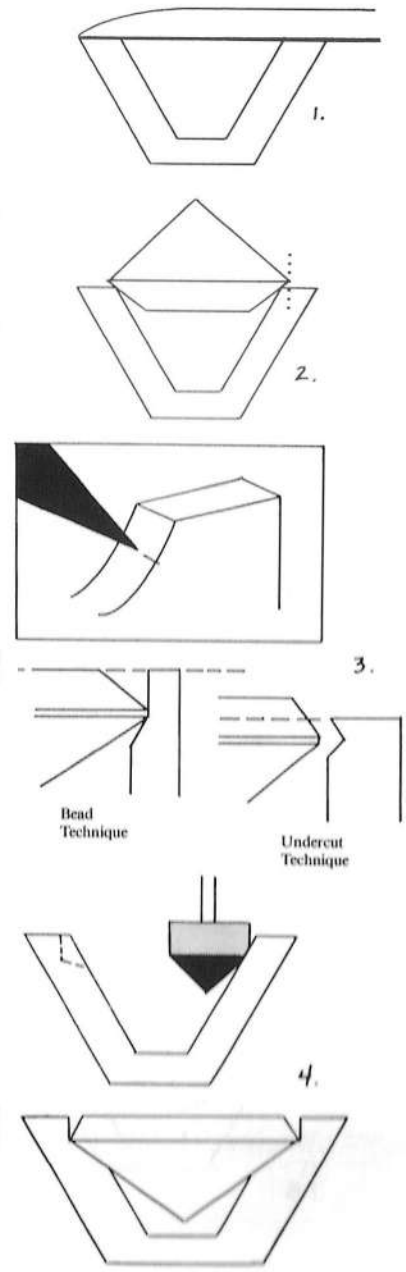
2. Place the stone on the prongs to test fit and to determine the depth for the stone girdle. Mark this depth line on each prong with a steel scriber.

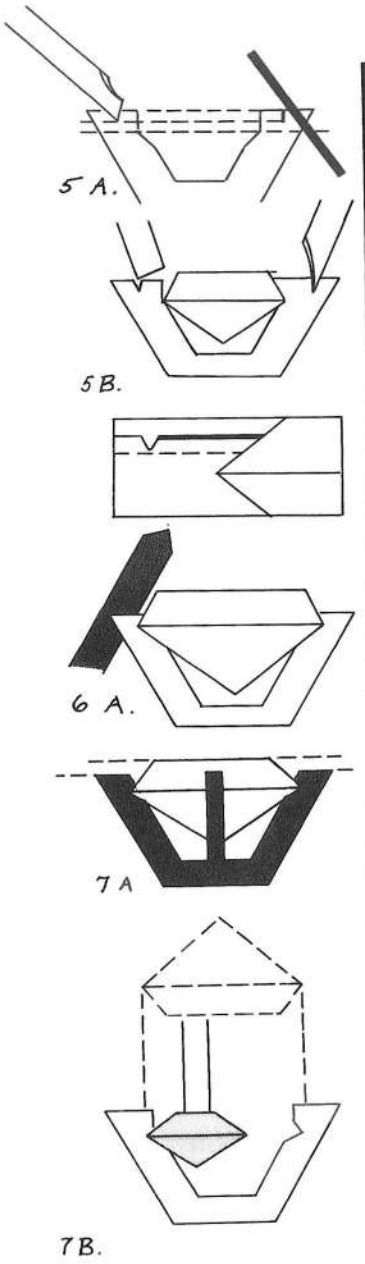
3. Ideally, if using a bead approach, the plane of the prong tops will be the same as the stone table and, if using an undercut technique, the prong tops will be slightly higher than half the crown height.

Optional Approaches For Seating Stone:

Bead Technique—*This approach is similar to bar-top setting in that you initially use a beading technique to secure the stone.*

4. With a seating bur smaller than the stone's diameter, cut the individual





bearings so the stone will fit snugly. Place the stone in the bearing "square on" after clean up.

5. With a #42 flat graver or a 6/0 saw blade cut bead notches to a depth that is halfway down the crown bearing. The cut should be started about the same distance from the bearing edge, so the metal section is nearly square. Pry the metal spur with a graver, prong pusher then use a hammerpiece to force the metal down tightly over the stone.

6. Use a #4 flat file to file each prong flat and parallel. Use a polished edge flat file to trim or bevel the metal edge over the stone. Smooth the metal, working to keep the prong edges sharp, flat, and parallel, then polish.

-or-

Undercut Technique—*This approach involves a hart bur or a 3-cornered file to undercut the prongs so you can "snap fit" the stone into the mounting. It requires much less filing because the top surface of the prong(s) is minimally disturbed.*

7. Using a small hart bur or 3-cornered file, cut the bearing at a depth so that the top surface of the prongs will be slightly more than half the crown height. Cut each prong bearing evenly so the stone

will lay flat, requiring some pressure to fit into the bearings.

8. It's possible that one or two of the bearing lips may need to be lifted with a graver in order to get the stone into its seat. Tighten the prong tips down with a burnisher or a hammerpiece.

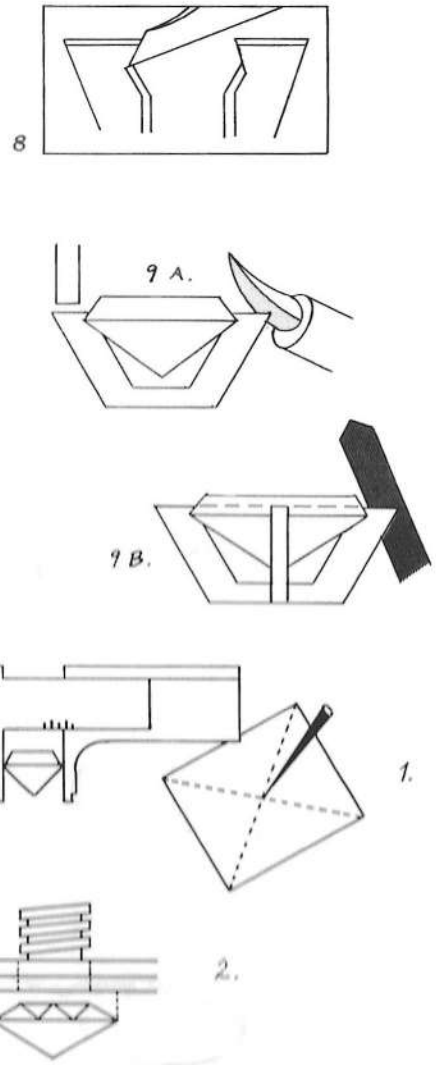
9. Clean any burrs or rough metal with a flat graver, emery stick, or pumice wheel. Then check each prong's top surface and parallelism with stone table and other prongs, and use a #4 flat file to make any corrections. Polish with tripoli and rouge.

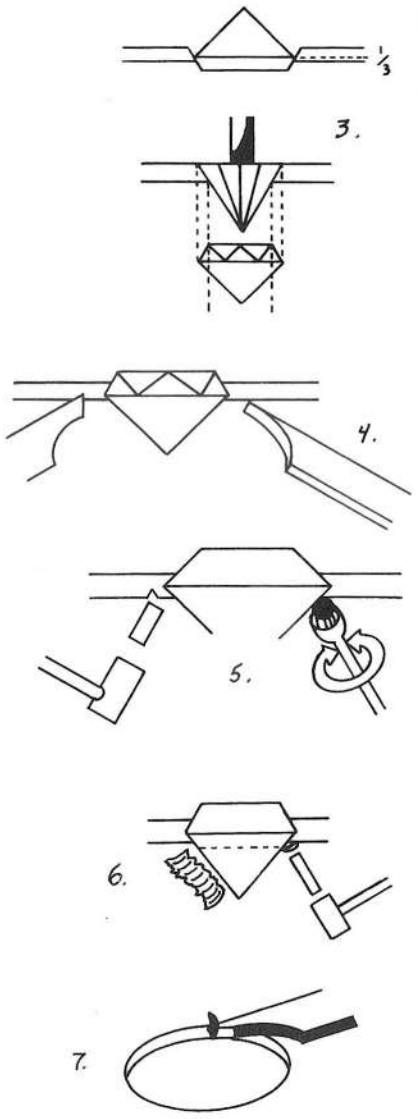
Reverse Bead Setting

This type of stone setting technique is rarely performed anymore. Instances will arise, though, when a reverse set is preferred. It consists essentially of drilling a hole and then raising a bead against the pavilion from below.

1. Measure the stone with a stone gauge or sliding mm gauge. Mark the center hole on the reverse side of the plate with dividers, steel scriber, or nick with a knife-edged graver. Punch the mark.

2. With a small drill in the flexshaft, drill the center hole.





3. Use a bud or cone bur to enlarge the hole so the opening on the top surface of the metal is slightly smaller than the stone diameter. Repeat stone fit testing as you use a #4 round needle file to taper the hole's sides to match the stone crown angle.

4. Press the stone, table first, into the hole firmly so that more than half of the crown protrudes through the top surface. Working from the underside, use a round graver to scoop at least four opposing metal slivers toward the pavilion.

5. Form the spurs into beads against the pavilion with a beading tool, pressing firmly, or use a flat ended tool and hammer to force the spurs against the pavilion.

Optional Technique: Rather than use a graver to raise metal beads or spurs, you can take advantage of gold's readiness to weld in a cold state. Fold up a series of three or four short sections of goldfoil and stuff these into the gaps between the slanted bearing walls and the pavilion. Press and burnish these wads tightly, using the rounded tip of an old beading tool shaft until they simply weld into a firm bead.

6. With a polished flat graver, slightly bevel the inside top rim of the stone's

retaining hole. Polishing is usually best done with a small flexshaft wheel.

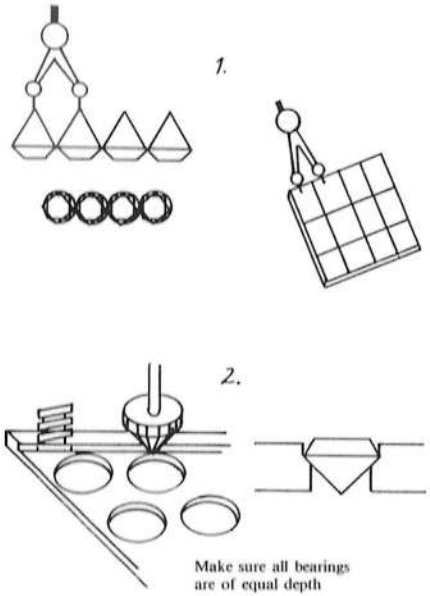
Pavé Setting

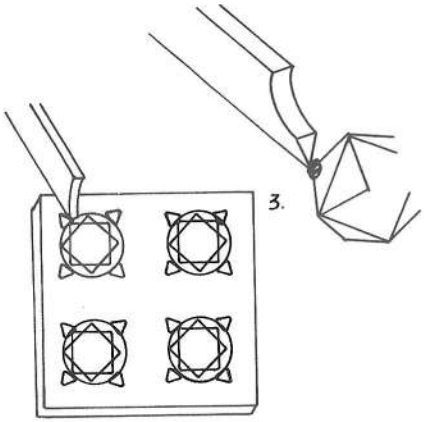
Pavé (from the French, "paved") is a type of setting in which a number of small stones are set close together with planned discipline, thus producing a paved appearance. The style of setting is usually beaded although prongs can be used to provide a similar appearance.

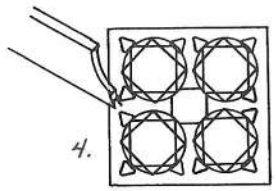
1. It's critical in pavé setting that stones be located accurately so their girdles are almost touching each other and—ideally—that all stones are set "square on." This pre-planning can be done in plasticene or wax on a flat surface and the center-to-center measurement transferred to the heavy gauge metal with dividers. Then each center is punched.

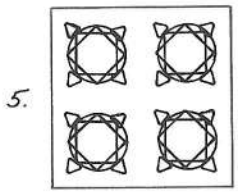
2. Drill a hole at each center punch mark, then cut out the bearings with a same size seating bur so the girdle rests just below the metal surface. It's very important that the bur penetrate to the same depth on all the stone holes so the stones will be uniform in height.

Note: In traditional pavé setting, the stone girdles don't actually touch each other. They're kept slightly apart to allow room to raise beads.









3. Allow for a minimum of three beads to grip each stone. The easiest approach is to raise the beads directly from the surface. With a round graver held at a steep angle, dig into the metal close to the bearing edge and push straight down, using the face of the graver to collapse a metal spur over the stone's girdle. Use a beading tool to form and tighten the metal beads so they grip the stone firmly.

-or-

4. An alternative approach in traditional pavé setting consists in marking out small triangular pads on the metal surface.. A flat, polished graver is used to remove the surrounding surface metal, leaving the pads as elevated metal platforms that can be readily lifted into place. The metal must be thick enough to use this approach which is often handy when you wish to employ a metal pad to grip more than one stone. Cut the bearings so the girdles rest at the level of the planed surface.

5. Once the bearings have been prepared, press the stones into place "square on." A touch of cyanoacrylate

glue will secure stones in the bearings while the beads are being turned (an Acetone soak will remove the glue).

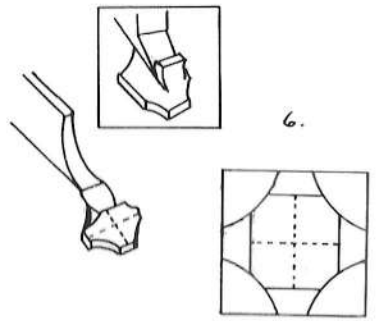
6. Push a round or wedged face graver at a sharp angle into each metal bead and allow the graver face to force a spur down and over the stone girdle (in the close quarters of pavé setting you don't have the luxury of distance or room between holes). Do each bead a little at a time, working against opposites. It is very important that the stones remain level and at the same height.

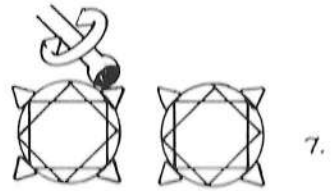
7. Shape and tighten down each prong spur with the beading tool. Keep the tool lubricated with Oil of Wintergreen (even spit!) Trim away any jagged edges with a flat graver, then polish.

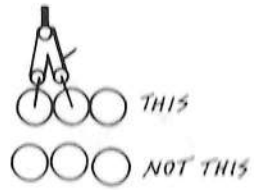
Raised Bead Pavé Setting

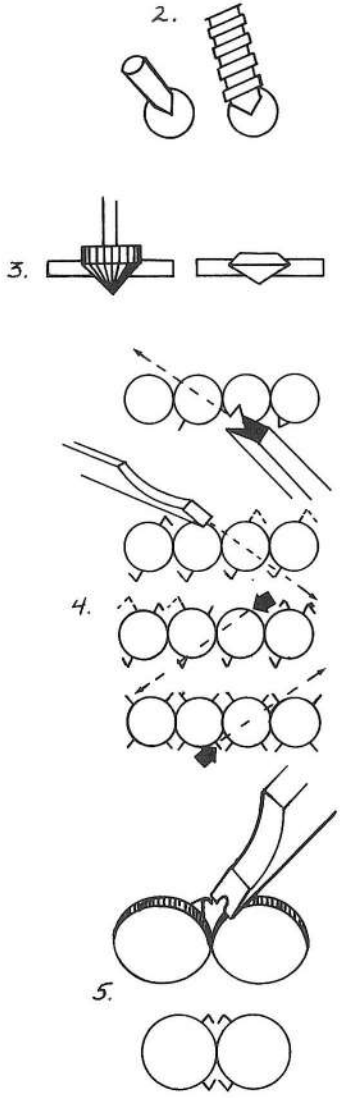
The previous instructions in pavé setting represented somewhat traditional type work, that is the stones are separated a bit. Contemporary stonesetters doing pavé work locate the stones much closer—and this is accomplished by lifting the beads out of the rims then removing excess metal.

1. Design the stone placement in wax or plasticene, then transfer these measurements to the metal, making a









nick mark in the metal with a graver tip or scriber at each center hole.*

2. With a centering punch, punch each hole center and then drill thru the metal with a drill whose diameter is smaller than the stone.

3. Use a seating bur with the same diameter as the stones and cut bearings in each hole. The vertical walls need to cover slightly more than the girdle—not the entire crown.

4. Secure the work either by bracing it or by imbedding it in a wax stick. With no stones in the holes, begin lifting small spurs from the inside rim of each hole using a relatively shallow (35°-45°)flat, polished graver. The graver cutting edge should face the center of the adjacent hole. Lift uniform sized spurs on a line sideways to the hole.

Note: These spurs will be pushed down over the stone not toward the stone center but rather in a sideways line as illustrated, otherwise you will have unattractive spacing between beads.

5. Cutting the spurs in sequence so the graver repeats its cutting direction gives you greater control of spur size. Don't bother to lift the graver to elevate the spur tips: this will be done later.

* Option: just place the stones table down on the work and mark the centers.

6. Clean excess metal away: 1) use a wedge faced graver to remove the metal between the holes and spurs, then 2) use a flat polished graver to remove metal from under spur tips

7. With knife edge graver, carefully separate adjoining spurs by cutting all the way to the previously cut-out section between the stone holes. With small round graver, lift individual spurs on a line sideways to the stone (again, don't try to elevate the spur tips yet).

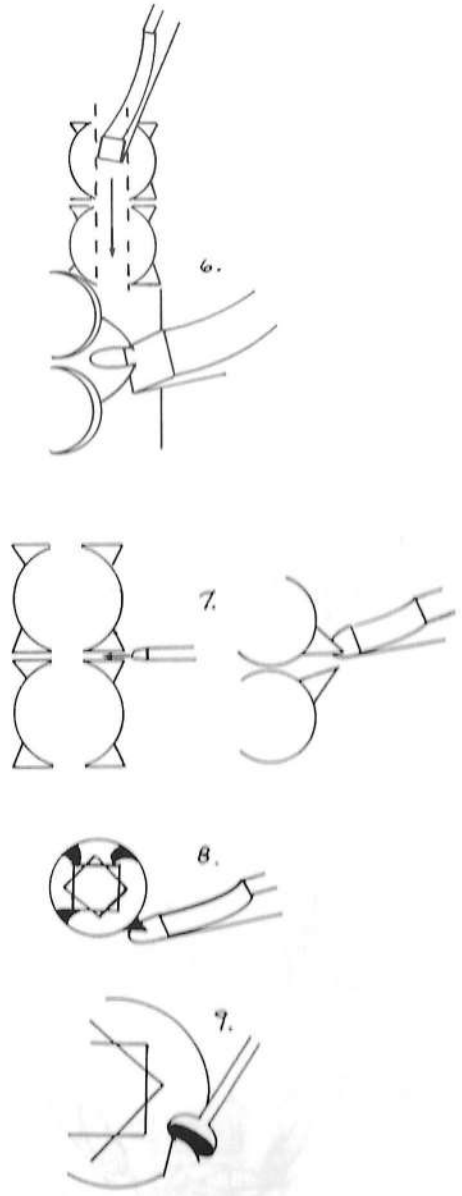
A flat polished graver can be used to remove the metal between the spurs and give the metal a bright polished look.

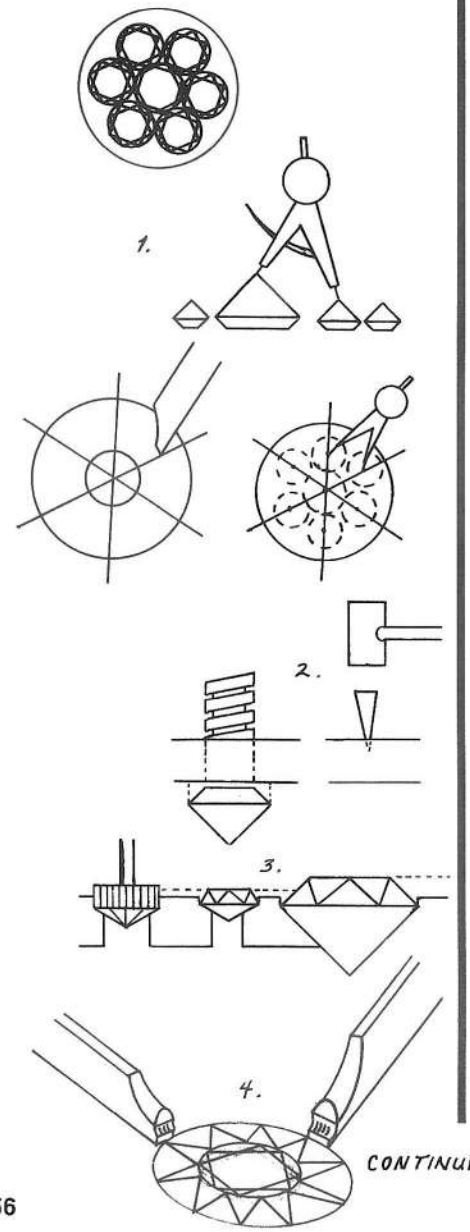
8. Position the stones "square on" (a touch of superglue helps keep them in place during the work period). With a flat or round graver, push the spurs over the stone, working in a line sideways to the stone.

9. Round and firm down the tips with a beading tool. Clean and, if necessary, polish.

Cluster Type Bead Settings

Cluster mountings of all types, styles and sizes are available commercially.





Many designs feature raised metal spurs which need only to be turned down over the stone. These can, within reason, be altered to suit a setter's choice. Alternatively, a cluster mounting is rather easy to fabricate from a flat heavy gauge sheet of metal.

1. Set stones in wax or plasticene and measure center-to-center distance, transferring the measurements to the metal with dividers. Relate all measurements in a cluster to the larger center stone (if there is one), working off its center. (See page 154 for direct technique.)

2. Punch each center mark then drill a small diameter hole completely through the metal.

3. Use a seating bur the same size as the stones' diameters to cut bearings for each stone.

4. With a flat graver, cut away the surface metal from any pre-planned pad locations which are evenly spaced around all of the stones—or raise beads directly from the metal. At intersections where more than one stone is to be gripped by a single bead or pad, allow for additional metal.

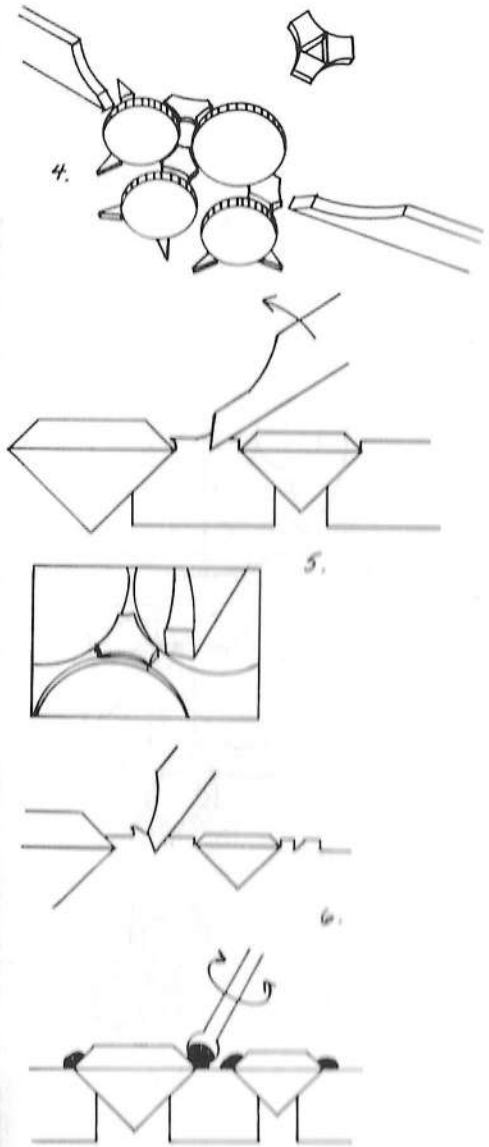
5. Starting first with the center stone, use an anglette graver to lift a portion of each intersection rim or pad, *cutting sideways* to a center location before lifting the graver face. Raise spurs in similar manner at other cardinal points.

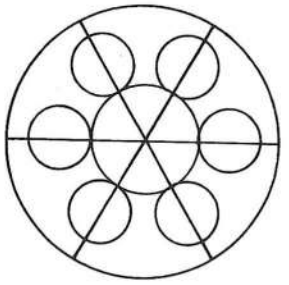
Outside spurs can be raised with a round graver, cutting toward center of stone. Use a flat graver to remove excess metal from around the lifted spurs.

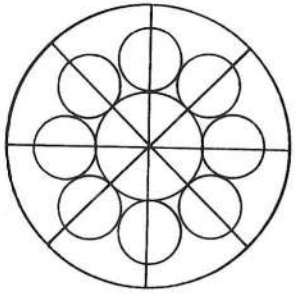
6. Place stones in bearings and secure in place by using a lubricated beading tool to round each bead and burnish it down tightly over the stone. Trim away any snags or burrs then polish.

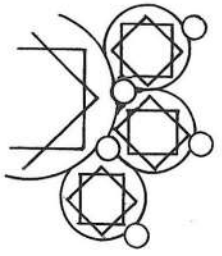
Cluster Type Pin/Prong Setting

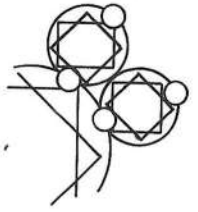
Many commercial cluster type prong settings, cast as well as die struck, require some element of undercutting, that is some of the prongs support more than a single stone. Often, too, to solve a space or setting problem a setter wishes to change from a bead approach to a prong or claw...especially when a single bead must accomodate more than one stone and the available metal is insufficient to raise a large enough bead.











The following instructions involve fabricating your own flat surface mounting, but the principles can also be applied to altering an exisiting setting.

The first step, obviously, is to decide on the configuration of the cluster, including the traditional 7- or 9-stone cluster pattern. Arrange the stones on wax or plasticene and measure their center-to-center relationship. With the dividers, transfer these measurements to the metal. The drawings given here show how to configure traditional clusters so the actual stone centers will merely depend on the diameters of the stones you're working with.

Mark the centers on the metal with a graver nick or scriber and then center punch each hole as a guide for the hole drilling.

Option #1

If you wish to change from a bead set to a prong cluster type mounting, or if you find in a pinch you need to install a prong to accomodate a setting problem, this option can be used:

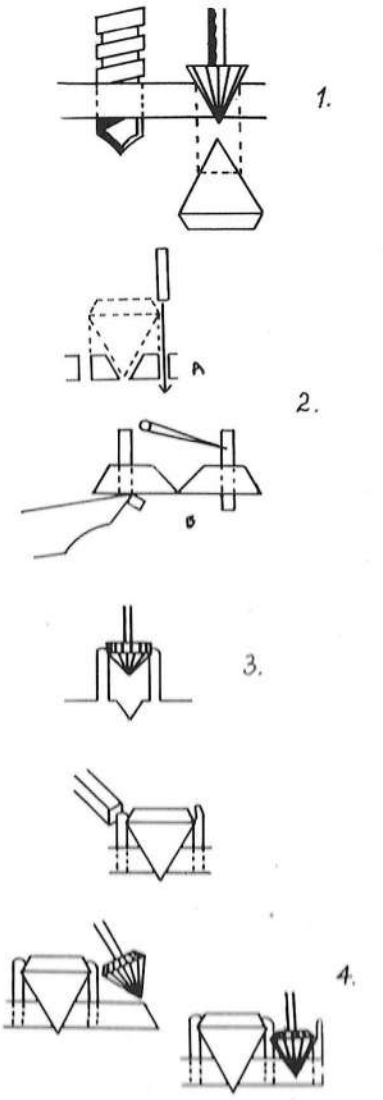
1. Drill a hole smaller than the stone then bevel hole slightly with a bud or cone bur. The bur-beveled hole's diameter should only fit the culet tip of the pavilion thus providing vertical support for the stone which will be gripped by prongs.

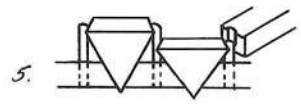
2. Drill tiny holes for metal pins at cardinal points, then solder these prong-pins in the holes. Trim off the bottom protrusions with a flat graver or abrasive wheel. Pin thickness will depend on prong 's intended use, whether it's intended to serve one stone or must be notched for additional stones.

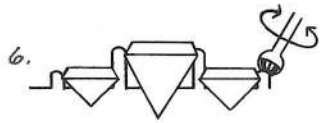
3. Mark the girdle bearing level on the prongs. Cut the bearings for the large stone with a hart or seating bur. Set the large stone first.

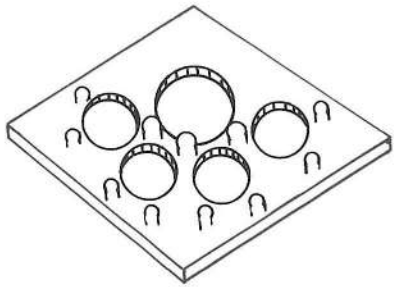
Note: As mentioned earlier, the large stone is always set first if its prongs are also to be used for smaller outside stones. If all stones have their own prongs, the small stones are then set first.

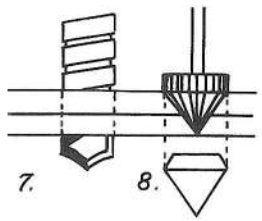
4. For smaller stones, first undercut the main inside support prongs with a hart bur then rotate the bur and cut the bearings on the outside prongs.











One prong for outside support makes for faster production but the stone can be lost if this prong fails (it's best to have at least two outside prongs.)

5. Snap the small stones into the bearings and secure by pressing the outside prong with a prong pusher toward the inside stone, forming a strong fiction fit.

6. For added security and appearance, use the beading tool to round the prong tips and firm them down.

Option #2

This option is quite useful if you want a cluster of stones in the low profile pavé or bead setting style but face a problem such as thin plate metal, difficult working area or you simply don't wish to graver away the surface.

7. Drill a small hole at each stone center mark, smaller than the stones' diameters.

8. Cut the bearings with seating burs whose diameters are the same as stones. Remove spurs and jagged edges with a flat graver, emery stick, or pumice wheel.

9. Cut or make beads, sized to fit at cardinal points between holes.

Note: Bead spurs can be made by sawing or snipping small metal pads from thick plate metal.

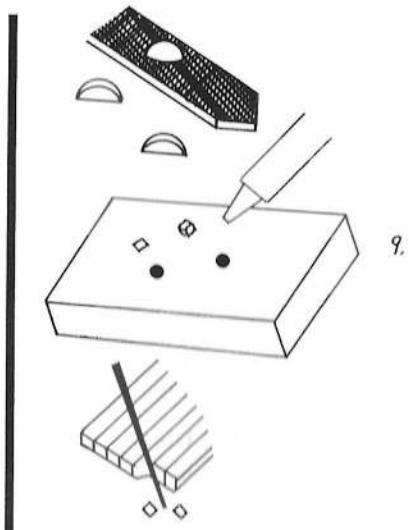
An alternative technique is to use a torch to melt small sections of precious metal on a charcoal block. Gold will ball up when melted. Allow the beads to cool slowly on the block then file a flat spot on the bead ball.

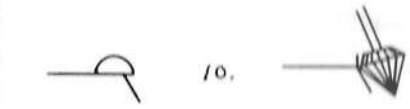
10. Sweat solder the beads or pads to the plate. The beads will probably require some preliminary shaping with a fine needle file.

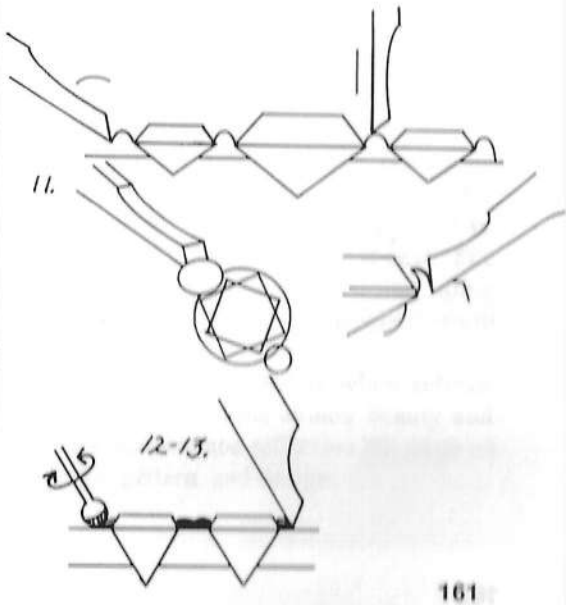
11. Place the stones in their bearings (a touch of superglue?) A flat or round graver can be used to lift the metal spur for each stone from the pads or beads.

12. Go over the turned over spurs with a beading tool and tighten firmly each bead down over the stone girdle.

13. Remove any jagged edges or rough metal with a flat graver, emery stick and/or an abrasive wheel. Smooth the metal and polish with tripoli and rouge.







To the Arab, they were but frozen tears of the Gods:

To which the Africans smiled, knowing them to be pieces of lightening which had fallen from the sky.

But the Hindu, when asked of the shimmering object, replied, "...it is captured light which I call diamond..."

CHAPTER SEVEN

Bezel Setting Techniques

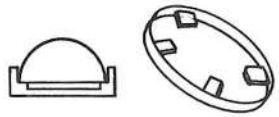
The techniques of bezel setting are quite similar to bead and prong setting, with a few major differences in approach and style.

The major difference lies mostly in the fact that the stone's perimeter is rimmed by a metal wall whose top edge has been burnished over the girdle of the stone to firm a firm grip.

When the metal frame is continuous and only the stone's crown is exposed to light bezel settings are described as closed type mountings. This contrasts with the à jour type mounting so characteristic of prong and bead setting.

In a closed setting the stone normally receives light only from above. The à jour setting (a widely used French expression meaning "open to daylight") allows the entrance of light from below or through the pavilion. Obviously, where light is important to the optical performance of the stone, the à jour mounting is best. For this reason, when a faceted, transparent stone is set in a bezel type mounting, some accomodation for admitting more than top light is often made such as open bottoms or open-sided or windowed shoulder bezels.

It's easy to understand the superiority of bezel type mountings when setting cabochons or similar gemstones cut with flat bottoms. These stones' beauty and excitement depend not so much on light for both refraction and reflection but more on reflected light alone to enhance their texture, color, pattern, and design.



Continuous rim or not, the bezel always features a seat or ledge so the stone can't fall through. Commercial bezel can be purchased with a ready-rolled seat...or, to improvise, metal snippets can be soldered on the inside perimeter of a bezel to provide an adequate seat.

Many setters contend that a bezel should extend about 1 mm above the girdle of the stone. This is usually true, but the prudent setter will study first any stone before making such an important decision. With bezel type settings, your efforts will be better rewarded if you keep two rules in mind:

The Initial Tight Fit...

1. The tighter the initial fitting between the stone and the unturned bezel the less likely you are to encounter metal folding or wrinkling when you turn down the bezel over the stone girdle. Take a few moments in the beginning to make certain you have a fit as snug as possible, and test constantly as you cut out the bearing to confirm that the stone will require slight pressure to snap into the seat.

The Bezel Height...

2. Because a bezel's height is dependent upon the type girdle as well as the height of the stone, study the girdle of any cabochon cut stone to determine how the lapidary handled the girdle. Often with smaller stones, the sides will curve uninterrupted to a flat bottom. On larger stones (and small ones, too) the lapidary will often bevel back the girdle portion. Also, for any number of reasons some cabochons are higher than others so their side curvatures aren't as severe as lower cut stones. For instance, because of the need for steeper crown angles so light

and mineral fibers can interact more visibly, star and cat's eye cuts tend to be much taller than regular cabochons. Both of these cutting factors—girdles and relative height—should be taken into consideration because they each impact so significantly on bezel height decisions.

Theory aside, just remember that the appropriate height for a bezel is one that provides for a secure grip without diminishing the attractiveness or the apparent size of the stone.

Although specific mention will be made of tool use in bezel setting, it is important to strive at the offset to learn effective use of the burnisher as well as the hammer and flat punch. Stones in bezel settings can generally be set by hand with a burnisher or a hammer and punch, although the latter does seem the preferred technique of veteran stonesetters. The reasoning is that they can more easily control the tools and the impact—and avoid damaging contact with the stone. Burnishers do have the nastiest habit of inadvertently slipping onto the stone and marring the surface.

For those vexing occasions when the bezels are a touch too thick or the metal is hard and springy no amount of hand work and effort will prove effective: your only reasonable resource is to reach for a hammerpiece in a flexshaft machine.

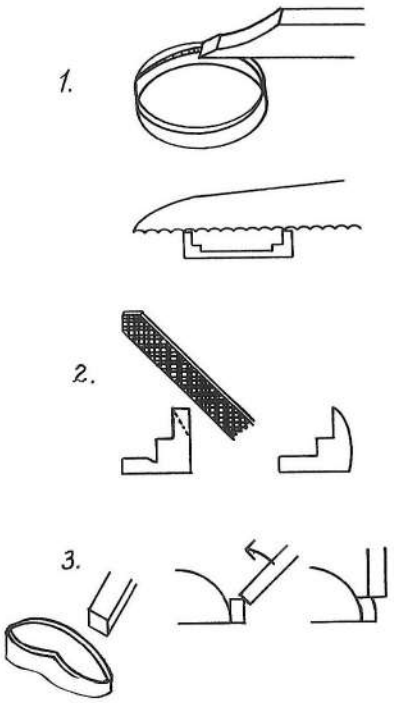
It is in bezel setting that the flat punch with a triangular face can be so helpful.

The hammer used should be a regular chasing hammer with a face of at least one inch diameter. The grip is standard with a forefinger stretched out along the handle so the hammer can be tapped rapidly and lightly with maximum hand and wrist control.

In summary, here are the general rules for bezel setting stones:

1. Assure a snug fit between stone and bezel either by filing the stone with a wet diamond file or by removing metal with a graver or machine file.
2. Select the appropriate height for the bezel on the stone.
3. Take extra precautions for any sharp stone corners such as the marquise, pear, heart, cushion, kite, triangle, etc.
4. Thin the back of the bezel—if necessary—and make certain the stone is level on the bearing.
5. Pinch or dent opposite sides of the bezel to lock the stone in place then burnish down, doing a small portion at a time
6. Smooth the metal and shape with a polished graver.

Cabochon Bezel Setting

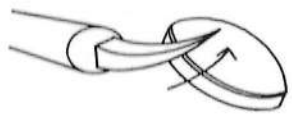


1. Evaluate stone size, height, girdle and test for snug fit into bezel. Make sure stone is resting level in the seat. If the stone isn't level, trim the ledge with a flat graver or file the stone with a diamond file until it is level.

2. Remove stone and file bezel to appropriate height with a #4 flat file. Trim and thin the top back of the bezel, if necessary, to promote ease in turning metal over stone.

3. Secure the mounting against movement on the bench or in a shellac holding stick. Pinch or dent the bezel on each side to lock the stone in place then gradually work the metal over the stonel. Watch for any sign of wrinkling and correct it before proceeding. Work slowly and avoid excessive pressure.

Option: Rather than use a hand burnisher, you can secure the stone against movement, then proceed to tap down the bezel with a flat punch and hammer—or a hammer handpiece in a flexshaft tool. If you use this procedure, close the bezel around the stone by directing the tool face toward the stone on the outer edge of the bezel. Tighten by hammering straight down on the bezel. A chasing tool or hammer disfigures the metal somewhat so be sure and leave some extra metal on the bezel: this can later be removed by a graver, file or abrasive wheel in the clean-up.



4. For final shaping of the bezel use a file, flat graver or small Cratex wheel. Be extra careful, particularly with soft stones, because the bright finish—the stone's major redeeming virtue—can be destroyed with a single slip of a graver or polishing wheel. Except for hard stones, it's probably best to polish the mounting with small flexshaft wheels.

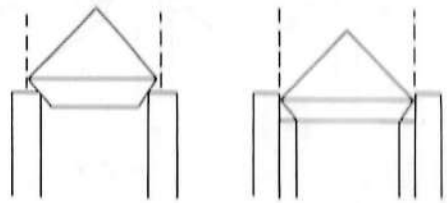
5. Check for tightness. If the stone wobbles, the bezel isn't down completely—or, worse, the bezel isn't high enough to grip the stone firmly.

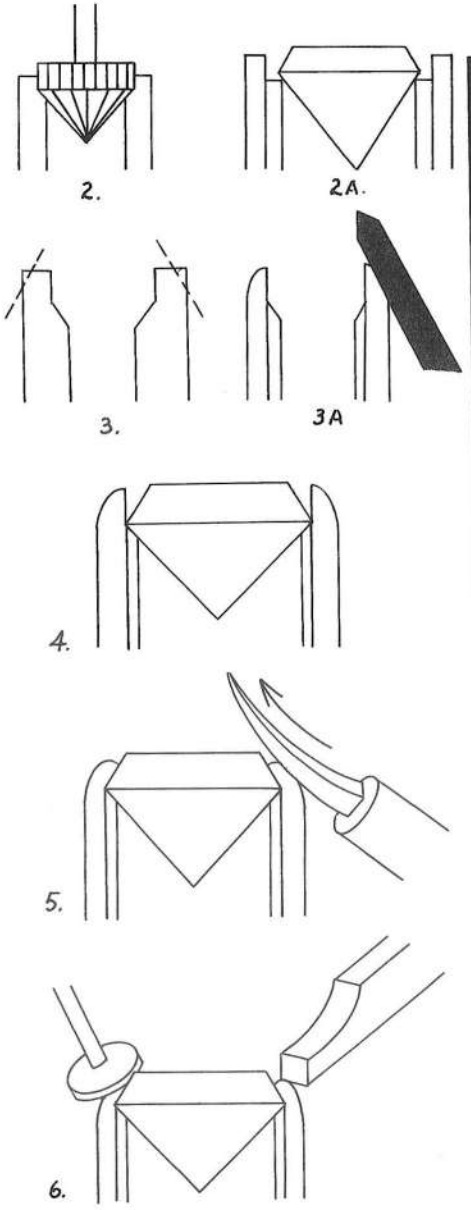
Tube Setting

1. Check the stone and the tube inner diameter (ID) for appropriate fit.

a) If the bearing will be cut out with a bur, select a tube whose ID is slightly smaller than the stone diameter

b) If the bearing will be provided by fitting a second tube inside then





select a setting whose ID is precisely the same as the stone's diameter

2. Solder in the bearing or else use a small seat bur to rout out the bearing. The tube wall holding the stone should extend more than halfway up the crown of the seated stone.

3. Check the tube thickness and, if necessary, thin and trim the outer top edge of metal with a #4 flat file.

4. Seat the stone firmly and evenly by snapping it into place. With small stones this can easily be accomplished by placing the stone table down on a flat surface and forcing the tube down over the stone.

5. Using a round hand burnisher, burnish the tube over the stone, applying burnishing pressure in the movement toward the stone (a flexshaft hammer can also be used).

6. Smooth the metal around the stone with a #4 needle file, emery stick or abrasive wheel. A polished flat graver can also be used to create a slight bevel on the metal edge adjacent to the stone. Polish with tripoli and rouge.

Gypsy Setting

1. Measure the stone diameter with a sliding gauge then drill a slightly smaller hole in the metal.

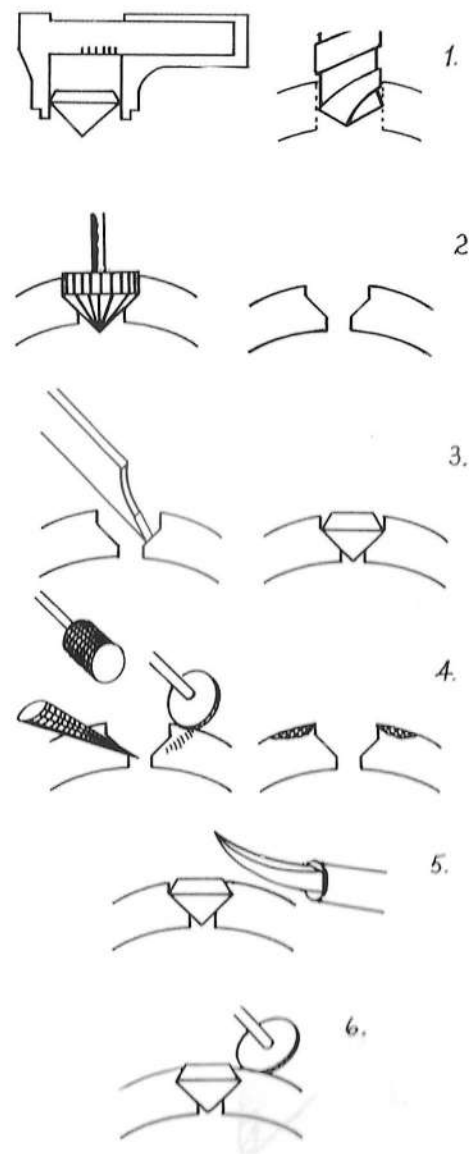
2. With a small round bur grind a bearing to a depth where the metal reaches slightly more than halfway up the crown height. The stone should fit snugly into the bearing, almost a snap fit. (A seating bur can also be used to cut the bearing in a gypsy setting, but hold it firmly because chattering becomes more of a problem as the size increases.)

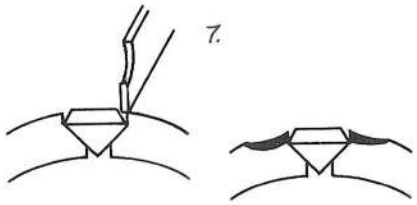
3. Remove any burrs or jagged edges then snap the stone into the bearing.

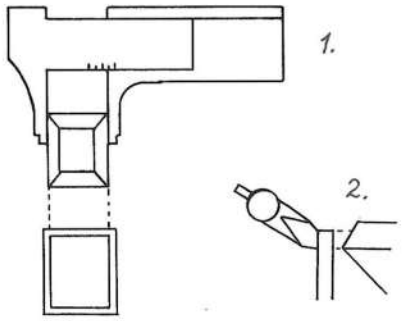
4. To create a raised metal ridge near the bearing hole it may be necessary to file away or use a cylinder shaped abrasive wheel in a flexshaft in order to remove metal around the bezel edge.

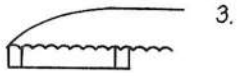
5. With a curved hand burnisher (or a hammer and flat tool), burnish the thinned metal down over the stone. Make certain the metal holds the stone firmly around the girdle.

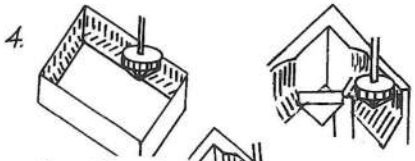
6. Use a #4 flat or half-round file or abrasive wheel to smooth and shape the metal surface.



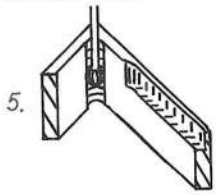








By removing metal beneath girdle line in corners. Pressure on stone tips is reduced.



7. Bevel the metal edge adjacent to the stone with a #42 polished flat graver. Polish with tripoli and rouge.

Bezel Setting—Cushion Cut

1. Check the mounting and bezels for uniformity, evaluating also if there already exists a bearing or ledge for the stone's girdle to rest on. Measure the stone and interior dimensions (ID) of the mounting to assure the stone's width and length will fit snugly. The stone should neither overlap nor fall into the bezels but rather need to be pressed snugly into the seat.

2. If a bearing must be made, mark the girdle level with a steel scriber, The bearing depth should allow the bezel to stand vertically a bit more than half of the crown's height.

3. Use a #4 flat file to file down the bezel tops to proper, uniform height.

4. Starting the bearing cut in the center of each bezel, use a seating bur to cut the bearings, coming as close to the tight corners as possible without overcutting.

5. Trim out the tight corners with a ball or krause bur, removing the metal

directly beneath the corner bearings to reduce stone corner tip pressure there. Finish the corner cutting with a flat graver. Use the sharp corner of an emery stick or a small stone bur in a flexshaft to trim away any jagged edges).

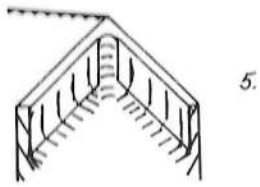
6. With a 6/0 saw blade, cut each corner bezel down to the girdle line. This cut keeps the metal from building up to form a wrinkled seam in the corners, and also reduces any potential pressure danger to the sharp stone corners. Before being folded down, the eight bezel corner ends can be tapered away from each other with a #4 needle file.

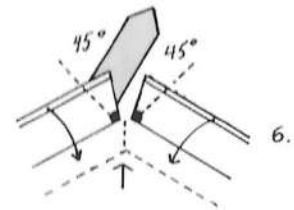
-or-

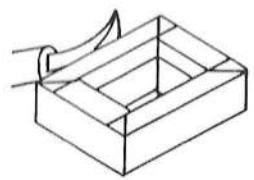
7. For a flush corner without saw cuts, first fold the short bezels over the long ones with a 1) burnisher; 2) flat tipped prong pusher, or 3) hammering tool.

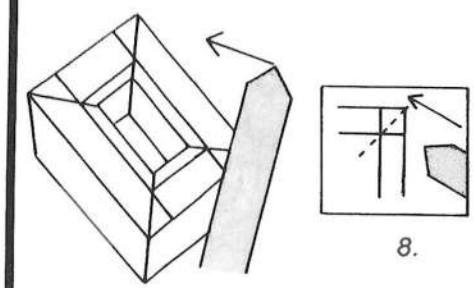
8. Work the bezels down as flat as possible, including the corner folds (often pliers can be used to squeeze the corner folds down). File away excess metal on the corners, working in a direction parallel to the long bezels.

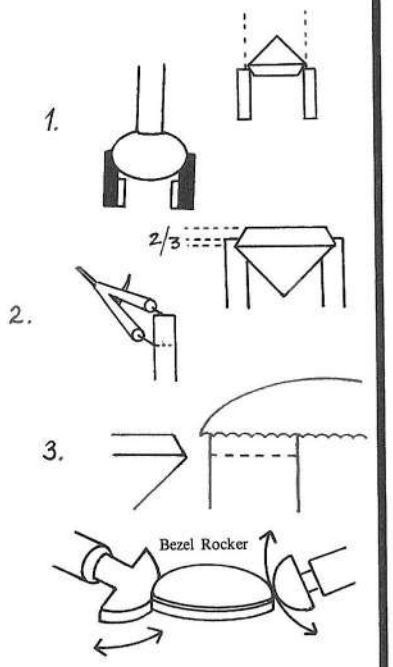
9. Use a flat graver to bevel slightly the bezel edges adjacent to the stone.











Burnish all of the bezels down evenly then trim away any jagged edges with a flat polished graver, emery stick, or abrasive wheel. Polish with tripoli and rouge.

Bezel Setting—Round Cut

1. Check the mounting and bezels for uniformity, evaluating also if there already exists a bearing or ledge for the stone's girdle to rest upon. Measure the stone and interior dimensions of the mounting to assure the stone's entire diameter will fit snugly. The stone should neither unduly overlap nor fall into the bezels but rather need to be pressed into the seat.

Note: If the mounting is too big, reject it. If the mounting is too small you can sometimes enlarge it slightly by squeeze-stretching the thin malleable metal walls with pliers, or forcing the walls out slightly with a dapping punch.

2. Mark the appropriate girdle level with dividers. The bearing depth should allow the bezel to stand vertically about 2/3 of the crown height.

3. Use a #4 flat file to file down the bezel tops to uniform height.

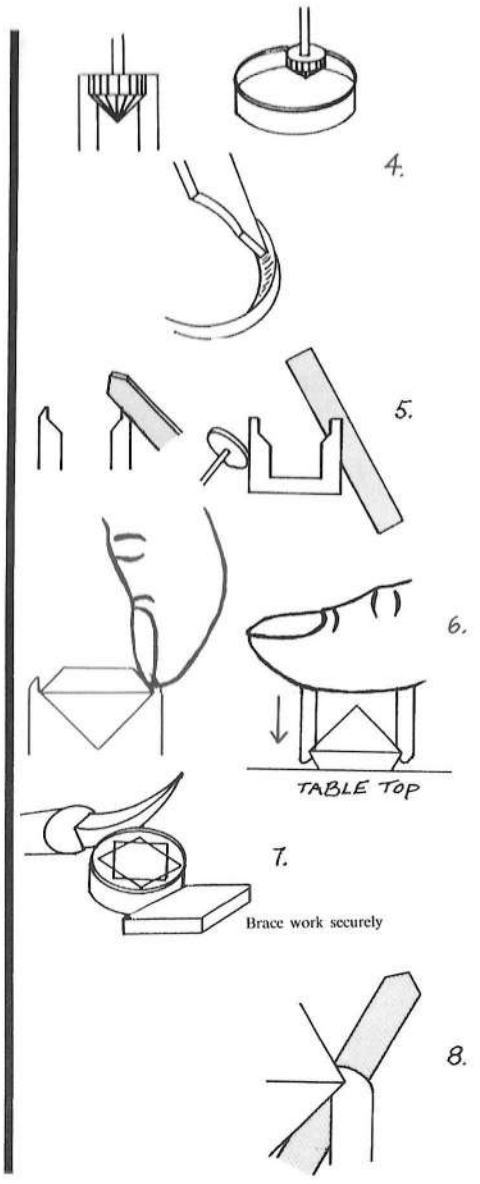
4. Use a small round or seat bur and cut the bearing carefully. Gradually deepen the bearing, testing stone fit at every step to assure a snug fit. Anything less than a tight fit will lead to wrinkling problems later. Use a flat graver to fine tune the bearing cut.

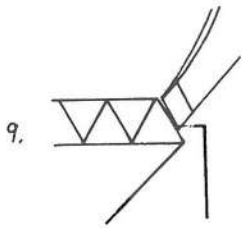
5. If necessary to aid in turning down the bezel, uses a #4 barrette file to taper the back of the bezel. Carefully smooth away the jagged edges and burrs, using an emery stick or an abrasive wheel.

6. Press the stone firmly onto the seat in the mounting. Adjust with fingernail or a wood dowel.

7. Turn the bezel over the stone on opposite sides to lock the stone in place, then bend the entire bezel down—working in one direction— with 1) burnisher; 2) flat tipped prong pusher; 3) hammering tool, or 4) bezel rocker. Make certain the entire bezel is down flat on the crown. To eliminate any gaps between the stone and the metal you may need to tap down the bezel, directing the tapping tool directly down on the bezel rather than toward the stone. For any hammering or tapping, make certain the mounting is secured against movement.

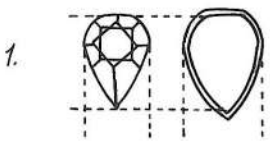
8. Using a #4 barrette file, smooth the top edge of the bezel down evenly all the way around.





9. With a polished flat graver, bevel the inside edge of the bezel. Finish off by smoothing the bezel and sides with an emery stick followed by polishing paper or by tripoli and rouge sticks.

Bezel Setting—Pear Cut



1. Check mounting and bezels for uniformity, evaluating also if there already exists a bearing or ledge for the stone's girdle to rest on. Very carefully measure the stone and interior dimensions (ID) of the mounting to assure stone's width and length will fit snugly. Stone should neither unduly overlap nor fall into the bezels but rather need to be pressed snugly into the seat to eliminate later metal wrinkling.

Note: The width to length dimensions on pear cuts varies considerably: some are squatty, some are slim. Before rejecting a pear mounting that appears too large in one dimensions, remember that a slight adjustment in the width will cause an opposite change in the length and vice versa. Often a modest manipulation can be used to form the desired snug fit, but if the mounting is still too big, reject it. If the mounting is too small you can sometimes enlarge it slightly by squeeze-stretching.

2. If a bearing must be created, mark the girdle level with dividers. Bearing depth should allow bezels to stand vertically about 2/3 of the crown height when the stone is properly seated.

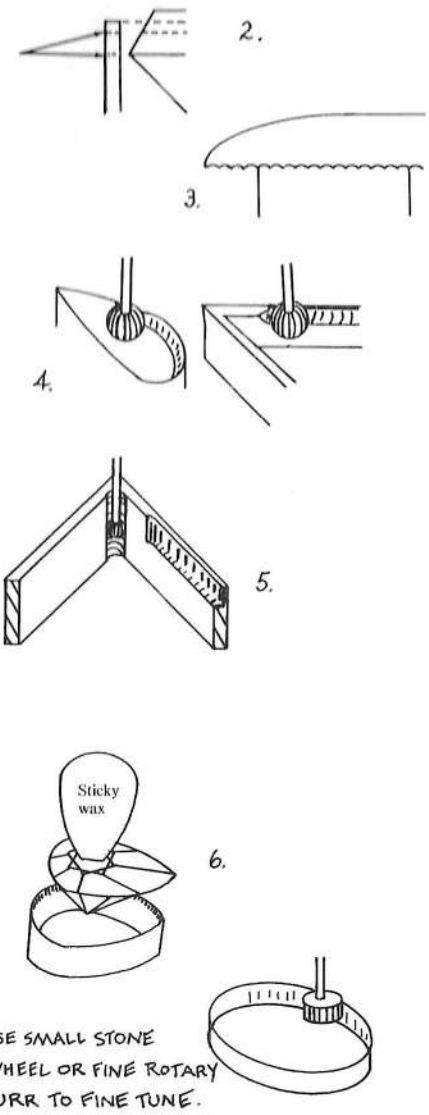
3. Use a #4 flat of half-round file to file the tops of the bezel down evenly to final height.

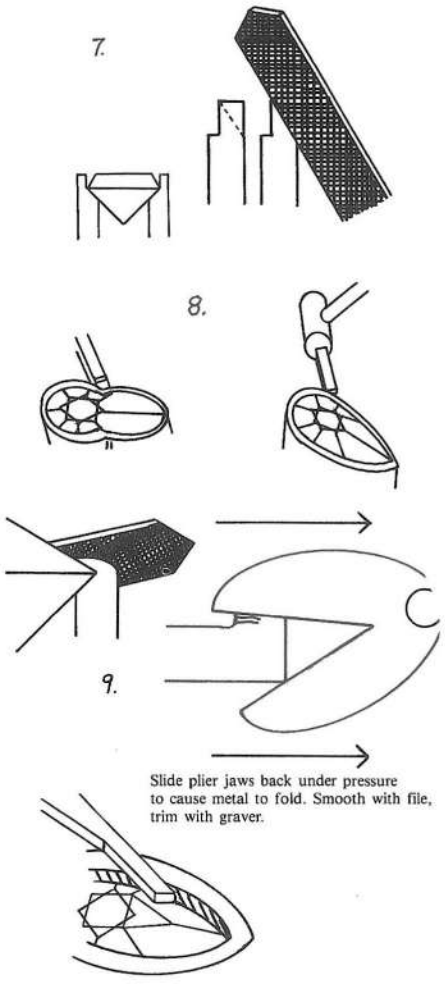
4. With a small round bur, begin the bearing cut on the inside rounded edge of the mounting and work slowly back toward the sharp corner. As you approach the corner you may shift to a smaller bur.

Caution: Don't try to get a perfect fit now but rather leave the final, critical fitting until after you've roughed out the entire bearing.

5. Hold the bur in a vertical stance while removing corner tip metal. To reduce possible tip and pavilion angle difficulties, remove metal directly below the girdle line in the corner.

6. Because of the need to test fit with the stone pavilion inside the bearing, attach a sticky wax or a Permagum stick to the stone and begin the removal of metal from the bearing. Proceed slowly with the final routing, using either the round bur, a flat graver, or even a fine stone point in the flexshaft.





7. When you have a snug fit, taper the back of the bezel so it can be turned down easily then clean up the stone and mounting. Insert the stone firmly into its seat. Check for any gaps between the stone and the inside bezel wall: close them with a prong pusher or a hammer tool.

8. With a flat tipped prong pusher or bezel rocker dent the bezel on each side to lock the stone. Finish the rest of the bezel with the prong pusher, burnisher, rocking tool, or pliers. Most setters actually prefer a hammer and flat ended setting tool for turning down bezels because it firms the bezel edges tight on the stone. To close the metal over the sharp tip fold the metal over with pliers then smooth with a #4 file, filing from the back of the tip toward the center of the stone.

9. Use a #4 barrette file to smooth out and shape the mounting. As an option you can use a polished flat graver to bevel and trim the edges adjacent to the stone. Polish with tripoli and rouge.

Flat Plate Set—Foil

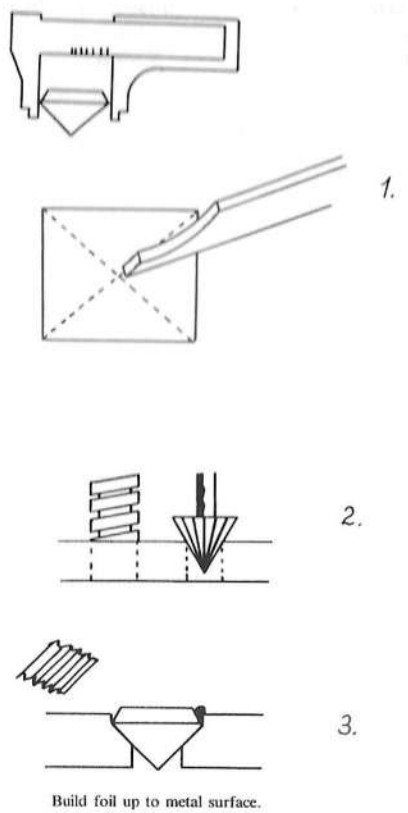
Gold's high malleability makes it one of the few metals than can actually be welded in a cold state. This feature allows a rather interesting setting option which proves most useful when a bezel type setting is desired under flat metal conditions.

1. Confirm the stone measurements with a measuring gauge. Nick the plate with a graver or scriber then center punch.

2. Drill a hole slightly smaller than the stone, then enlarge hole with seating bur so stone girdle will seat slightly below metal surface. Clean out burrs from the hole but be sure to maintain the snug stone fit.

3. Place the stone level in the bearing. Roll up a small section of gold foil and use a small, rounded burnishing tool with a firm back-and-forth scrubbing motion to press the foil down tight between the crown bearing and the stone's girdle. Work the foil under hard pressure until it physically welds with the mounting metal. Use more foil to cover any areas that burnishing exposes.

Note: The necessary small burnishing tool can be made out of an old bearing tool or the tapered end of a topless 1/32" bur shaft. Make certain shafts have been annealed then shape the tips round on an India stone. Polish the tips on a 4/0 emery cloth.



Build foil up to metal surface.

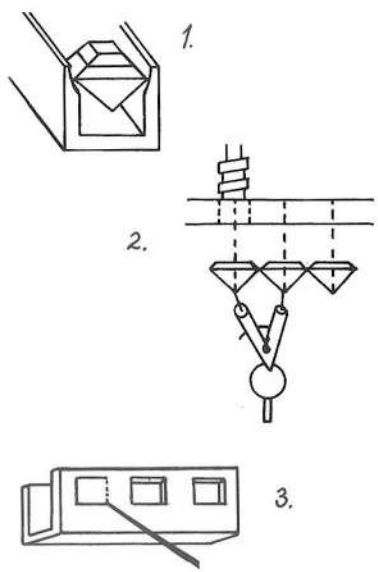
Channel Setting—Calibrè

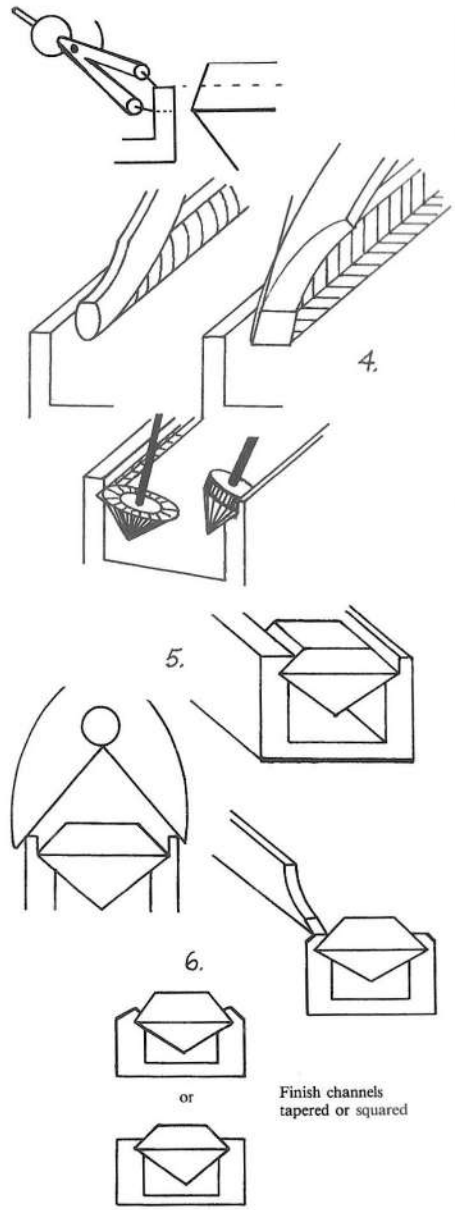
Small colored stones of rectangular or square shape that are used in a decorative motif, commercial or self-made bands or guard rings are called calibrè or carré. Calibrè can be set in any style, but most often appears bezel set in channels, either closed or à jour, where consistency of shape, dimensions, and mounting technique is desired.

1. Evaluate the channel mounting for appropriate size and uniformity. Are à jour openings clean and pavilion holes placed properly for the size stone you intend using? The edges of calibrè should extend over the channels at least 1/3rd of the bezels' thickness.

2. If you must make openings in bottom of channel then measure stones carefully with gauge or lay out in plasticene and use dividers to transfer center-to-center measurements to setting. Use this same technique for any side windows: Calibrè girdles should almost touch each other.

3. Punch bottom openings then drill holes on mark. Side holes can be pierced with a drill then the window on both sides sawed out with a 6/0 blade.





4. Mark with a steel scriber or dividers the bearing level so the top of the channel will be slightly more than half as high as the crown. The channel races on both sides can be cut out with a small round graver or a seating bur. Remove any burrs or jagged edges with a flat graver.

Option: Instead of a ball or seating bur you can use a hart bur or square graver to undercut the channel walls. The stones would then be snapped into position. This is a rather dangerous technique, though, because the danger of breaking or chipping stones that are softer than diamond is already rather high and this approach compounds that problem.

5. Place the stones next to each other in their races, their girdles barely touching. Check to be sure the stones' tables are all on the same level (a touch of cyanoacrylate glue will help keep the stones in place).

6. Turn the bezels over the stone with a flat prong pusher or a pair of pliers working slowly and carefully. The Pull-Down Pliers are exceptionally useful for turning over channel edges.

If the metal is too thick consider slightly filing down the back of the channel so the edges can be turned easier. Use a #4 barrette file or emery stick to remove any metal disfigurements and finish up by going over the channel edges

with a polished flat graver.

7. Check again for straight even lines in the mounting then finish with tripoli and rouge.

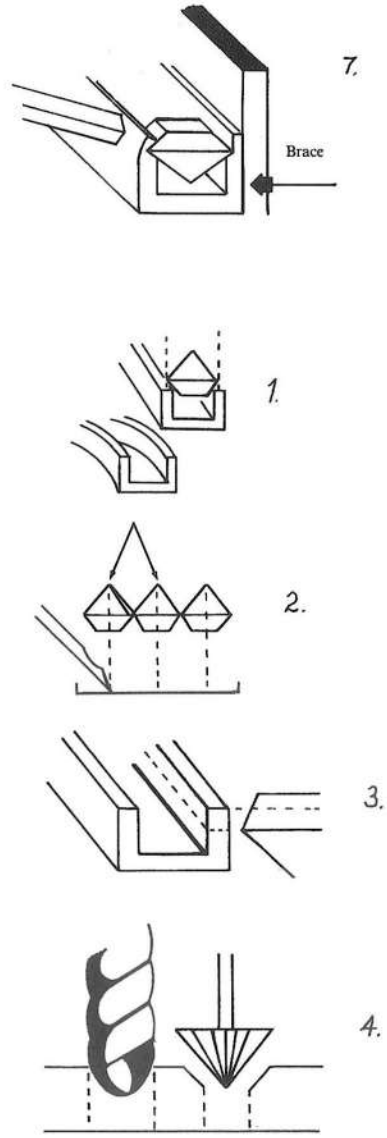
Channel Setting—Round Cuts

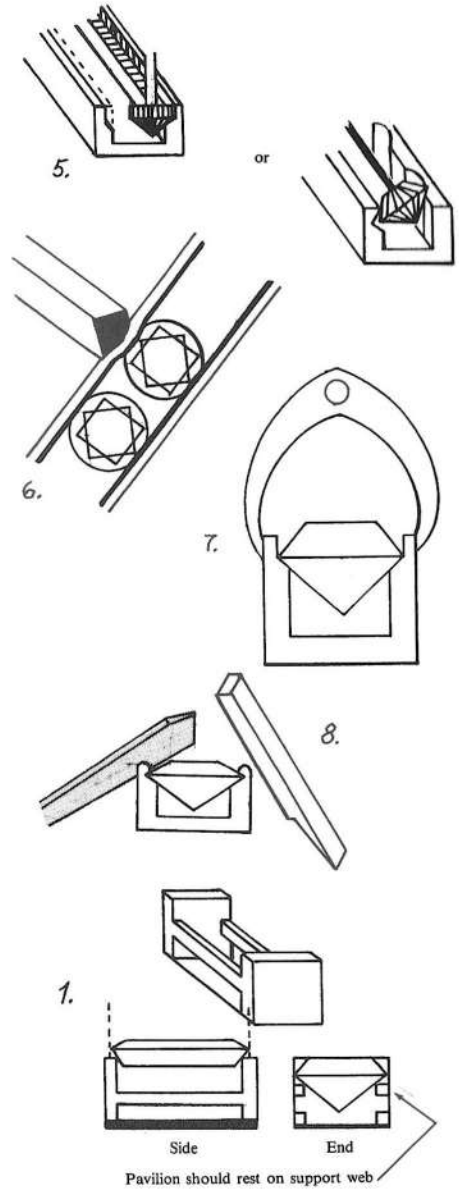
1. Confirm that measurements for channel and gemstones are appropriate for each other. Stone girdles should extend over channel edges at least 1/3rd the metal thickness. **Remember:** it isn't absolutely necessary for round cut stone girdles to touch each other—but the closer the better.

2. Lay out stones on plasticene and transfer center-to-center measurements to metal with dividers. Nick or scribe the center hole locations.

3. Mark the girdle line with a steel scriber, knife edge graver or divider. The girdle level should provide for the channel top height to be slightly more than half of the crown height.

4. Punch the center hole nicks then drill the openings. Enlarge each opening to about half the stone diameter with a bud or cone bur.





5. With a small hart bur cut separate notches in both channels directly above the bottom openings. Tip the bur slightly both at the beginning and completion of each cut so the stone can be snap fitted into place later.

Option: A few setters use a larger hart bur to undercut one channel wall then rotate the bur so it slices a vertical bearing in the opposite channel. This option requires more metal bending to lock the stone in place and subsequently more extensive metalwork to regain parallelism in the channel appearance.

6. Remove any burrs or jagged edges, then snap the stones into their cut out seats. Check to assure that all stones are level, even and "square on."

7. Tighten the channels over the stone with a flat tipped pusher or use pliers.

8. Use a #4 needle file, a flat graver, and/or emery stick to smooth out the metal and shape the edges as desired. Polish or burnish.

Channel Setting—Baguettes

1. Individual ready-made baguette

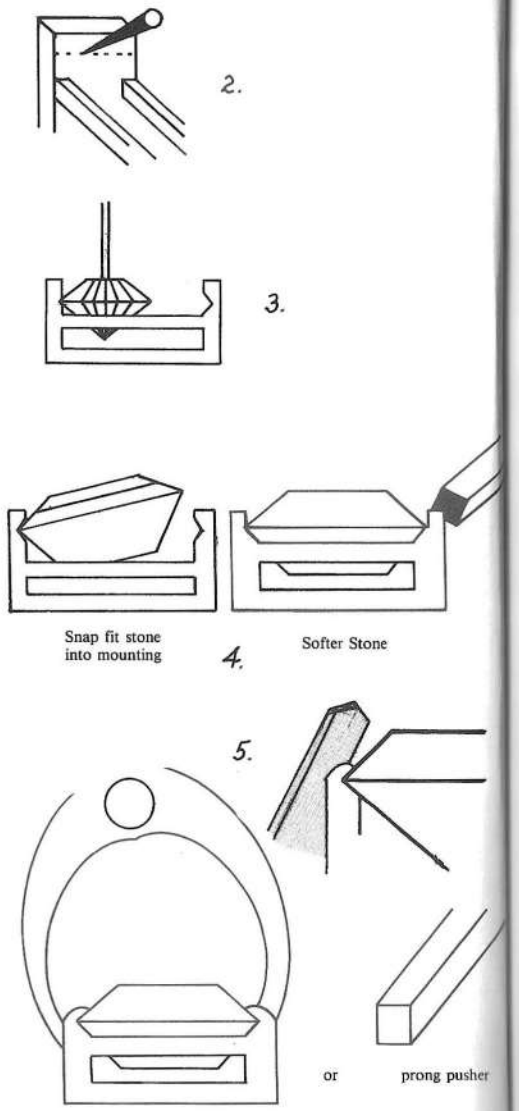
mountings are commercially available. Test the stone for fit and plan the bearing notch to allow the stone pavilion to rest on the support web wherever possible.

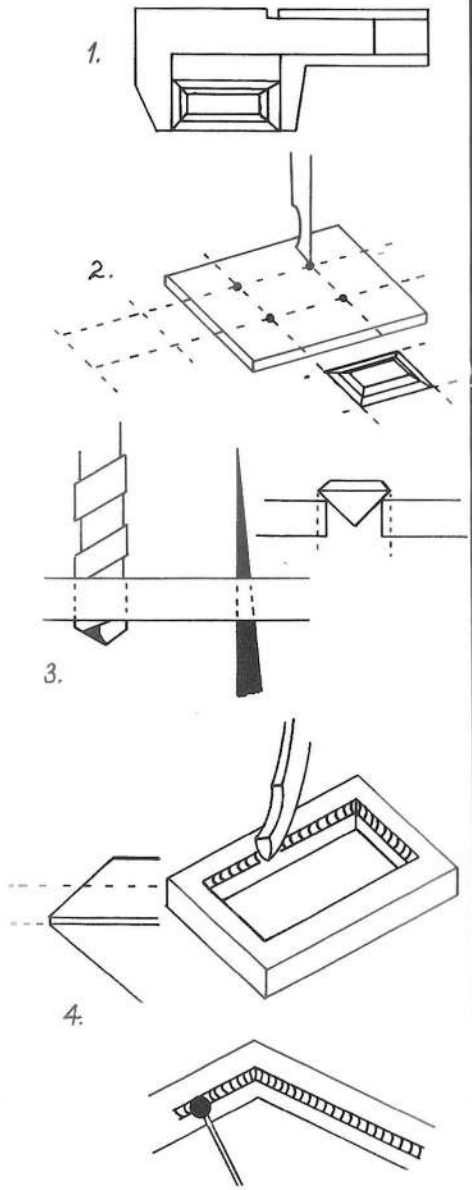
2. Mark bearing levels with a steel scriber or knife edged graver.

3. Cut the bearing notch in both bezels with a small hart bur, or square graver. **Caution**: Since the stone will be friction-fitted into the bearings, match the stone length carefully to the depth of the bearing cuts.

4. After removing any rough metal snap fit the stones into the bearings (baguettes are predominantly cut from diamonds but when you do encounter colored stone baguettes plan to allow extra bearing room so the stone can be inserted with a minimum of friction. Many setters cut a vertical crown bearing in one of the sides so the softer baguettes can be more gently placed in their seats.

5. Tighten the diamond with either pliers or a flat tip prong pusher. Shape and smooth the metal with a #4 barrette file and/or emery stick. Polish or burnish. For colored stones, also use a flat tip prong pusher with minimum pressure and maximum care.





Flat Setting—Baguettes

1. Use a sliding gauge to measure carefully the stone's dimensions and to assure sufficient setting space is available.

2. Mark the perimeter of the stone in the metal, nicking with a steel scriber or graver, then follow with a punch where the drill will be inserted.

3. Pierce the metal with a small drill then with a 6/0 saw blade open the hole in the base metal to slightly less than the total dimensions of the stone(s) to be set. Place the stone(s) over the opening and evaluate the fit: girdles should extend slightly over the top surface—enough to provide a bearing.

4. Mark the bearing depth with a steel scriber or knife edged graver so the top of the metal is about half as high as the crown on the seated stone. Cut the bearing in the shoulder of the opening with a small 0/11 ball bur or an anglette graver held at about a 60° angle. Dimensions are important here because you want to snap fit the stone into the bearing if at all possible.

5. With a file or abrasive wheel in a flexshaft remove some of the metal from the surface near the opening so a small ridge of the original metal thickness will be available as a bezel.

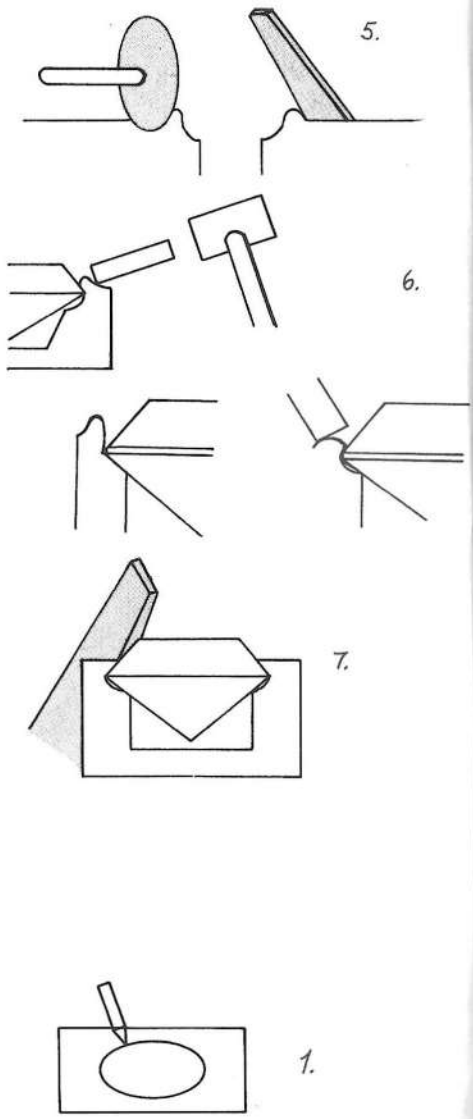
6. Snap the stone into the plate. With a flat faced punch, or a hammerpiece in a flexshaft, bend the metal ridge down onto the stone(s) girdle.

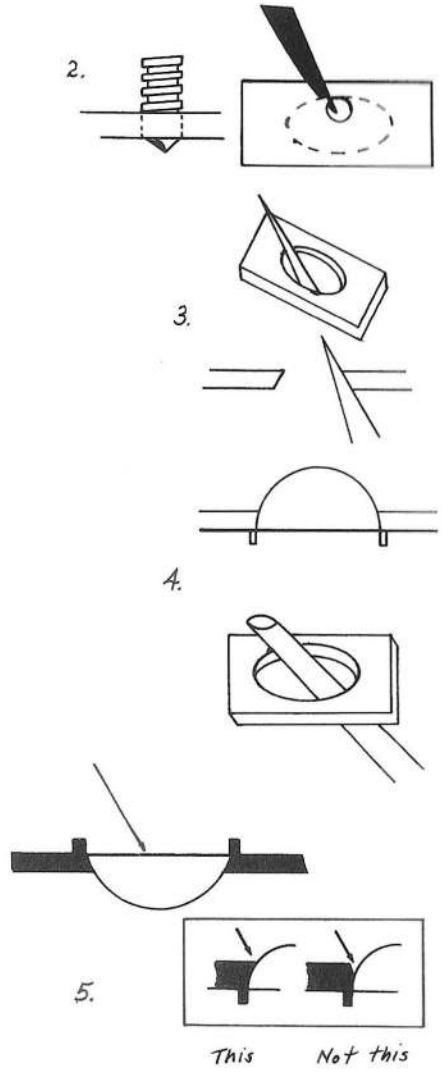
7. Smooth the metal with a #4 barrette file, and bevel the metal edges adjacent to the stone with a flat polished flat graver. Polish with tripoli and rouge.

Reverse Set Bezel

Reverse setting a cabochon with a bezel is similar in approach to the procedure for prong reverse setting although a reverse bezel mounting can also accomodate faceted stones whose pavilions extend beyond the bottom of the metal (it's generally not a good idea, though, to reverse bezel set a faceted stone because the bezel's reflections are picked up in the stone's table).

1. Measure the stone and carefully transfer or trace the outline on the metal.





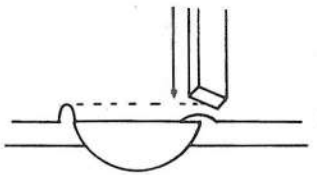
2. Drill a piercing hole in the metal then use a 4/0 saw blade to remove a slightly smaller cutout than the stone's actual measurements.

3. With a #4 round needle file form a reverse taper in the sides of the cutout at an angle closely matching the dome of the stone. You want as close a match as possible for maximum gripping ability—with no gaps at the top between the stone and the metal.

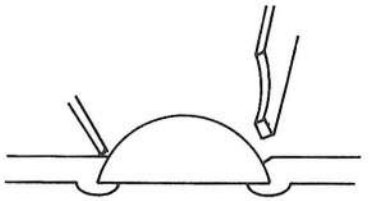
4. Test the stone for fit then clean away any rough metal or spurs, being careful to maintain a close, tight fit between stone and metal cutout. A small rolled up section of emery cloth is excellent for fine tuning the tight fit.

5. Press the stone into the cutout from behind and check that the stone is tight and level with the bottom of the stone flush with the metal's bottom surface—with no gaps showing on top (You can file the opening some more or use the option in Step #7 given here).

6. If the fit is acceptable, brace the mounting upside down and use a flat punch and hammer to fold the bezel down firmly over the stone's bottom. **Note:** Because the stone-to-metal fit is so critical, it's generally good practice to make the cut-out then solder the bezel into place.

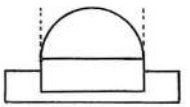


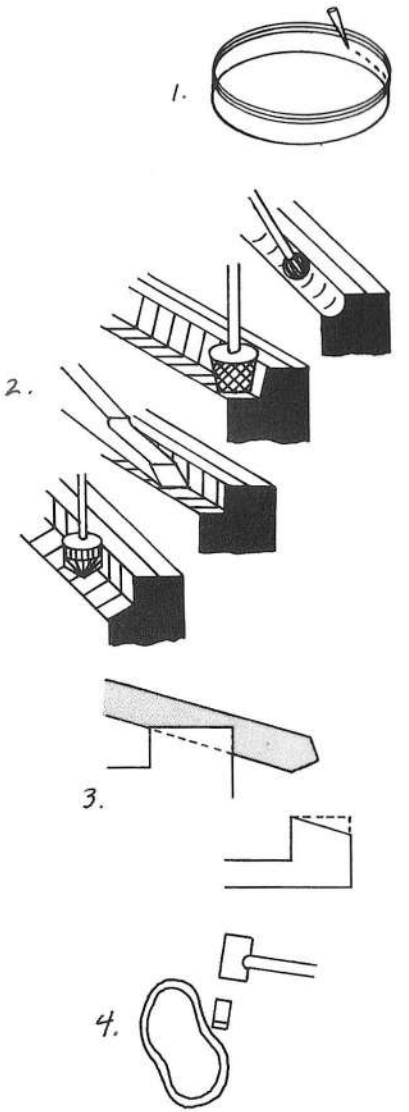
7. With the stone in place, check the top contact between the metal and the stone. Since any gap can be closed only by pressing or deforming metal down toward the stone, consider using a flat, polished graver to bevel the inside metal edge, thus keeping the top metal surface flat. Use a graver to remove any jagged edges or burrs then polish.



Biseau Setting

A biseau (French , meaning steep, beveled edge) is a unique bezel type setting that grips the bottom of a steep sided cabochon stone yet offers the highly attractive feature of a wide, flat metal ledge. A steep stone—such as a cat's eye or star— best displays the proper effect.





1. Measure the stone and mounting carefully to assure a snug fit. Test fit the stone and then mark the inside of the bezel with dividers or a steel scriber.

2. The bearing must fit the stone's bottom contour precisely. To cut a flat bottom bearing, make the ititial cut with an anglette graver or small round bur, then finish the sharp angles with a flat graver. A rotary file in a flexshaft machine is excellent for flat bottomed cabochons. A seating bur, of course, performs well for stones with a beveled bottom or pavilion.

3. Bevel the tops of the bezel with a #4 flat file then brace the mounting on the bench or implant in a shellac or wax stick.

4. Press the stone into the snug bearing and dent in the bezel on opposite sides with a hammer and punch so as to lock the stone in. Complete the rim with the hammer and punch, doing a little at a time and working in one direction. Inspect your work often to assure a tight, perfect fit where stone and metal meet (the triangular punch is helpful here).

5. With a #4 barrette file smooth down the marred bezel top, watching out that no file teeth contact the stone (wax the file's sides as a lubricant, just in case!)

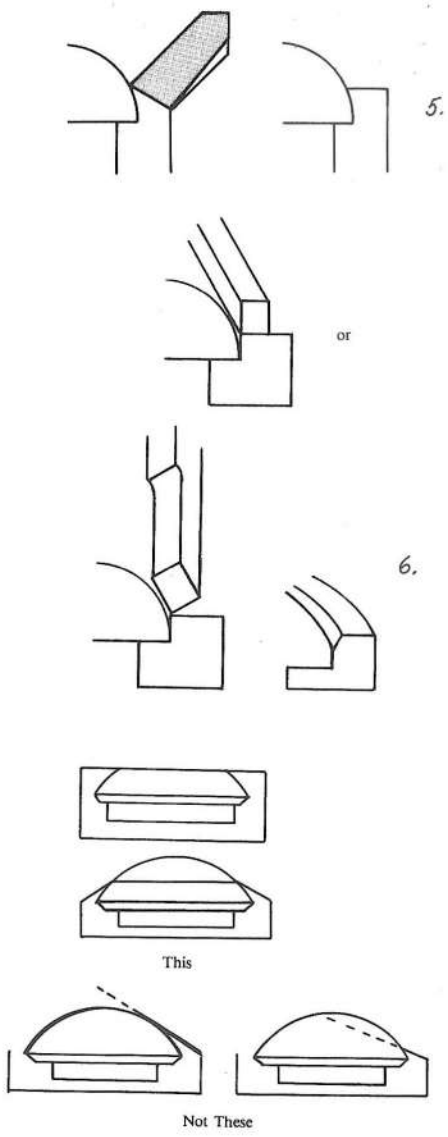
6. A wide polished, flat graver can be used to final trim the bezel top flat. If you haven't produced an accurately flat bezel top (and it's not all that easy to do without experience), use the polished flat graver to bevel the inside edge of the metal: such a polished bevel distracts the eye from noticing the lack of flatness. If necessary, polish the mounting.

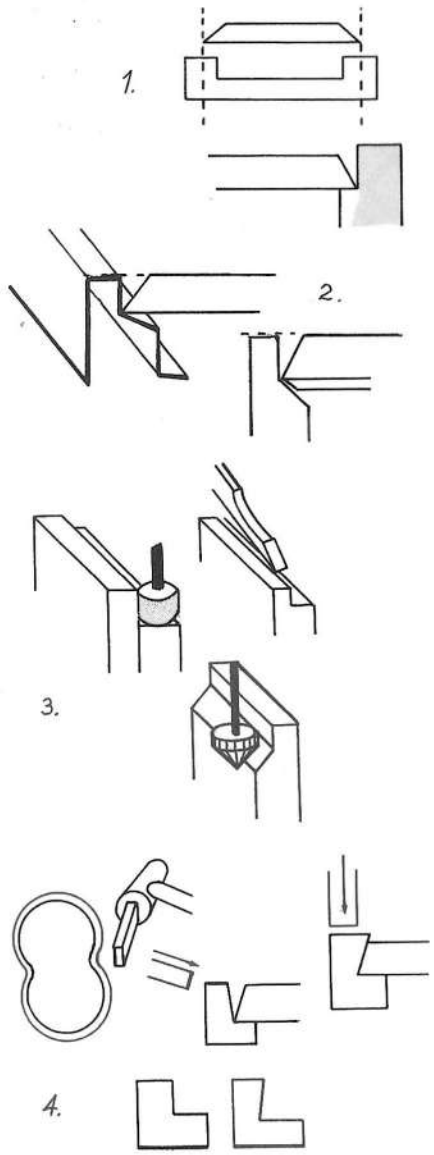
Mirror Setting

A mirror setting dramatizes a flat topped stone by keeping the top of the stone and the top of the bezel on the same plane. An attractive setting technique, the mirror setting obviously is most suitable for stones with wide, flat tables and near vertical girdles and/or crowns.

A shallow domed stone can also be set in this manner although the top edge of the bezel often requires slight beveling because of the difficulty in maintaining the integrity of the angle plane.

The key to a successful mirror setting lies in the consistency of line between the slope of the stone and the bezel.





1. Compare the dome shape of the stone and the height and size of the mounting. You want a snug fit with bezels that allow the stone to sit rather deeply (the bezels should be slightly higher than the stone table when the stone is in the bearing) because of the need later to remove metal from the bezel tops.

In an ideal stone, you want high, steep girdles or crowns with little or no pavilion.

2. If using commercial hollow die struck bezel, make certain the crown bearing is exactly the same as the stone (usually the stone will neet to be re-cut if they don't match) because the hollow frame's metal height can't be reduced.

3. If fabricating your own bezel, cut an adequately deep bearing that conforms precisely to the stone's contour:

Flat bottomed stone—use a flat graver or a rotary file

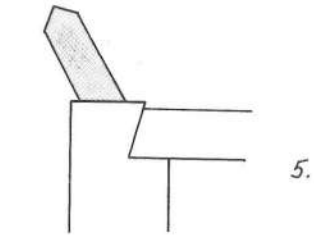
Angled pavilion stone—use a seating bur

4. Secure the mounting against movement and place the stone into the bearing. With a flat punch and hammer, dent each side to lock the stone in, then proceed to chase the rest of the bezel down tightly against the stone.

5. With bezel firmly against the stone, its top should be higher than the stone's table: use a #4 flat file to smooth the metal down nearly flat with the table plane (it's takes considerable practice to make it come out even—especially when you don't dare touch the stone's surface with the file). Finish with a flat graver.

Note: Truth is, in most production shops the setter gets it as close as he can then hands the unfinished job to a lapidary. The latter smoothes both metal and stone down even with a flat 600 or 1200 grit pre-polishing disk, finishing with an appropriate polish on a flat wheel. It's extremely difficult to produce a mirror setting without touching or marring the stone's polished surface—and while careful hand burnishing accomplishes a lot it often won't produce the uniform, flat polished dual surface offered by flat lapidary disks.

6. If you do polish by hand or with a machine, keep in mind that the direction of polish should be parallel to the stone or metal not only to maintain a straight metal edge but to avoid any polish damaging contact with the stone's surface.



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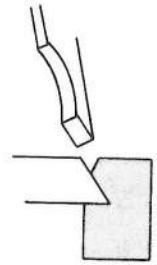

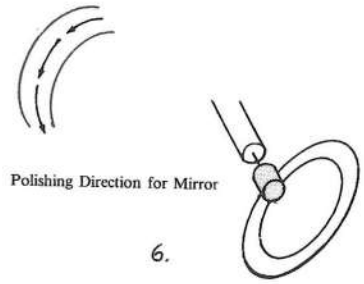

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CHAPTER Eight

Buffing and Polishing

From a commercial viewpoint, the most important stage in the creation of a piece of jewelry is the final stage—the buffing and polishing. It's here that the adage "...the metal work will sell the piece..." is played out.

Your setting technique may be superb. The stone may be a master cut of flawless, clear beauty. But if the metal work is shoddy, if the polish is poorly done even an uninformed jewelry buyer will pick up on this quickly.

Good metal work and polishing technique are obvious. Poor work is even more noticeable.

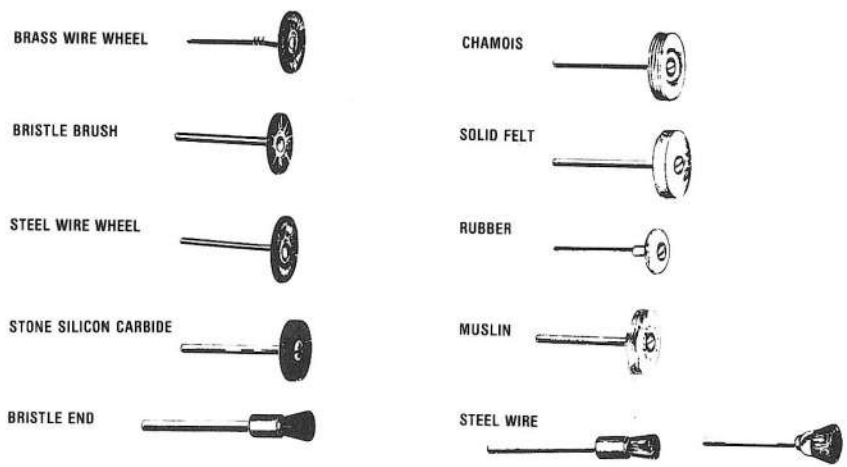
Throughout the chapters on setting techniques, the final step was generally an abrupt "polish with tripoli and rouge" or more simply "polish or burnish."

In this chapter, you will be introduced to some of the niceties of gaining a shimmering polish on your work. If throughout the setting operations you have been careful to remove or avoid all of the scratches, dents and dings then a fine polish where the rich, varied play of reflected light and images can dance across an undulating surface should present no difficulty.

Hand Polishing Provides Precision...

Polishing by hand offers some distinct advantages over machine polishing: it's safer, usually more precise, and errors take longer to develop—and less time and effort to remove.

A flexshaft provides an acceptable compromise between the slower hand method and the swifter lathe machine type. A variety of small buffing and polishing wheels are available to the setter and these can be changed quickly and conveniently—sometimes too conveniently because many people move directly from tripoli to rouge without first removing the tripoli. This often results in contamination of the polishing wheels—a condition that is virtually impossible to correct—to the detriment of the polishing operation.



Tripoli and rouge are the polishing agents most often used in the flexshaft and the jeweler's polishing lathe. To remove the danger of contamination, keep tripoli and rouge buffs and brushes in separate drawers or compartments. Even the slightest trace of tripoli on a rouge buff will become evident when the latter simply no longer produces the reflective mirror polish you want.

Contaminated Buffs Won't Polish Well...

Instead the contaminated buffs will provide only a satin like finish. This dull finish won't disappear until the metal is exposed to a clean, uncontaminated rouge buff or brush.

Contamination occurs when you mix the buffs or when you don't sufficiently remove tripoli from the metal before proceeding to polish. Even where the carry over is in minute amounts the cumulative impact will be to ruin your rouge buffs. The only alternative usually is to throw the contaminated materials away and start over.

As a very minimum step against contamination, after using tripoli always at least wipe the article clean.

One of the conveniences of buffing and polishing with hand sticks is that their working pads can be encased in a plastic bag or wrapper when not in use.

Tripoli, which consists essentially of a decomposed siliceous rock abrasive combined with an oil binder, can be purchased in peel-back containers or in brick form. The container is generally preferred because it can be applied to the sticks or wheels without becoming imbedded in the skin. It's dirty stuff to work with.

Rouge, a product of iron oxide usually combined with wax or other binding substances, is also available commercially in a variety of forms and colors including raw sticks or peel-back containers.

Red rouge is the most common. Here are the various rouge colors and their corresponding metal types:

Rouge Color Coding

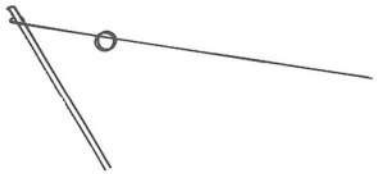
Red —— Silver and for yellow, red and green gold.
Yellow —— Hard metals such as platinum, chrome, stainless steel.
White —— Platinum and for white gold.
Black —— Platinum, silver, white gold.
Green —— Chrome, stainless steel, platinum.

When using tripoli or any other fast-cutting abrasive to remove minor scratches, marks and dents keep in mind that these substances smooth out all surfaces. This includes sharp metal joins or edges which you might not want rounded. To avoid

over-cutting with a relatively uncontrollable abrasive, perform the major part of metal smoothing and preparation with files and emery sticks.

Indeed, some setters perform their metal work with polished gravers and burnishers so completely that often the only finishing work is a short touch-up with the rouge buff or brush.

Keep on hand polished straight and curved burnishers so you can get those difficult areas where the wheels won't reach. In working with a burnisher, always use a lubricant such as a soda-free paste soap, light machine oil, Oil of Wintergreen or, in a pinch, saliva.



For openings on the inside of mounting cages or between prongs, etc. attach a small cord or nylon string to your workbench. Pull the string tight with your hand and coat it with tripoli or rouge respectively. Thread the string through any difficult area you encounter and trum—abrade or polish with the treated string—by moving the work back and forth along the string with pressure.

Trumming often represents the only viable alternative for responding to these difficult polishing problems.

The cut-down action of rouge is almost nonexistent. It should be applied to the buffs rather sparingly because its action is part polish and part burnish. If you're still getting a less than mirror finish despite contamination precautions and a well prepared surface chances are you're merely using too much rouge.

To reduce an excessive rouge build up on a buff or brush hold a file or a rough piece of wood to the turning wheel and wear it off quickly.

Here is a procedure for hand polishing. It can also be used for small flexshaft wheels or a polishing lathe with only slight modifications:

Metal Preparation...

1. Perform most of the metal smoothing and preparation with files, emery stick, burnisher, and/or abrasive wheels. Brush metal filings and residue away completely. Clean with detergent any dirty, residue that builds up.

Buffing...

2. If necessary, do final smoothing with a tripoli charged stick, preferably hard felt. Tripoli can also be charged on wood, whose sharp angled edges come in handy for working on sharp metal intersections, corners, and edges.

Polishing...

3. Remove all coarser abrasives. Diamond mountings can be cleaned with steam, ultrasonics or by boiling in a water-detergent solution. Many colored stones can also be subjected to mechanical cleaning methods—but check the stone and its specifications first. Remember: the safest cleaning method for mountings containing colored stones is a warm water detergent and a soft brush (bristle...NOT NYLON!) — plus a bit of elbow grease.

Explanation: A nylon cleaning brush is a danger to the mounting, not necessarily to a diamond or hard colored stone. While brushing vigorously, the nylon fibers may snag on the metal or a jagged edge. Nylon is exceedingly tough—and the metal will break or bend before the nylon does...and this loosens stones in their mounts. That's why a soft bristled brush is best for cleaning jewelry containing stones.

4. Let the work dry...a hair blow dryer as well as blotting tissues are effective and quick. Moisture collects the rouge dust and this combination is difficult to remove.

5. Polish with a stick to which rouge has been applied, rubbing rapidly and with as much pressure as the work will allow. The general consensus is that you should

hand polish in one direction as much as possible to achieve the brightest finish. With machine polishing, the friction creates a surface flow which fills in and smooths over previous work: therefore it is helpful to "cross polish"."

Option: For small, complicated work that simply doesn't lend itself to the handheld stick, use a bristle wheel brush charged with rouge. See Chapter Three on tools for preparing such a brush. The bristle brush is about the only way to get into some areas that can't be reached by hand or ordinary machine buffs.

6. Inspect the piece carefully for any areas that were missed. In those areas that resist your efforts with buffs, brushes, or trumming, realize that they'll usually tarnish quickly again anyway.

When you attain the desired finish, clean again in a heavy detergent solution. Blow dry or dip in alcohol then allow to dry in sawdust.

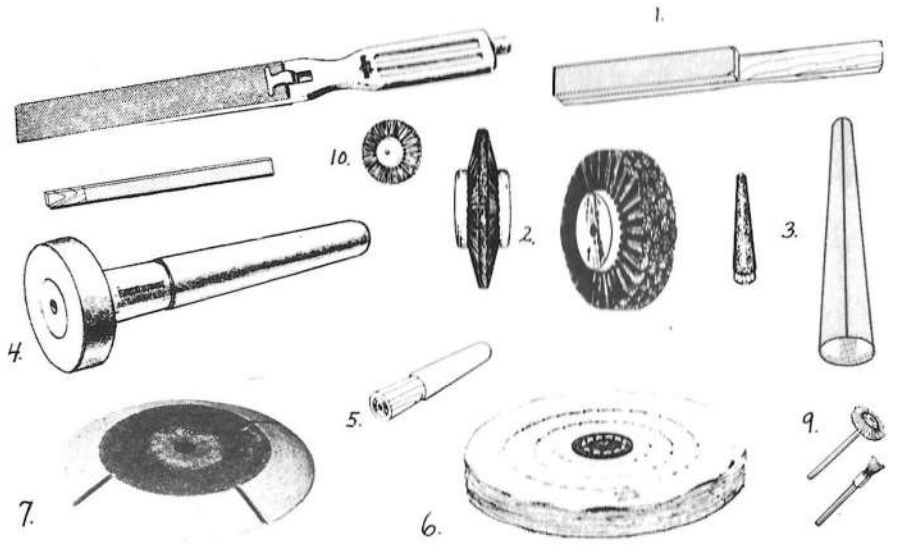
Equipping For Polishing Operations...

Equipping your shop for buffing and polishing operations is a relatively easy matter.

For hand polishing, a pair of felt tipped sticks...one for tripoli and another for rouge...represent an adequate starter. Still, though, you'll encounter enough of a variety of polishing challenges that a more extensive inventory of supplies is required.

You're reasonably prepared for about any task with the following starter inventory:

1. Pair of hard felt sticks—for hand buffing and polishing.
2. Bristle wheel brush—for small, complicated work.
3. Inside emery ring buffs (with wood taper)—for metal smoothing on inside of rings (available in several grits and also with paper or cloth backing).
4. Combination felt ring and wheel buff—for convenient buffing of inside and outside of rings (usually used with tripoli).
5. Inside felt ring buff—for polishing inside of rings (often used with rouge).
6. Fine muslin, cotton flannel or chamois buff—for polishing with rouge. (A regular muslin or hard felt wheel can also be used effectively with tripoli).
7. Hard felt wheel (lapper)—for flat or square surfaces, sides of ring shanks.
8. Knife edged wood or knife edges hard felt lap—with tripoli or rouge for sharp joints or crevices.
9. Brass wire brush—for cleaning and surface finishing yellow metals (gold, brass, copper).
10. Steel wire brush—for cleaning, deburring, and surface finishing silver, aluminum and other white metals (a straight steel brush will modify the metal surface).



The above list of supplies may obviously be expanded to include more items. You'll find no shortage of imaginative products in wheels, buffs and tools designed to make buffing and polishing operations more efficient.

Techniques in Machine Polishing...

Machine polishing is more difficult to master but it does allow for a considerable time saving. With a lathe turning anywhere from 1800 to 3600 rpm the elements of heat and friction are added to the polishing equation.

It's friction that causes the surface of the metal to flow. This is a beneficial condition, but only as long as you remember to "cross polish." Excessive pressure against the polishing wheel should be avoided because it will cause the metal to "burn" rather than take on a high polish.

If you notice rouge caking on the surface of the work while you're polishing it means that too much rouge is being used or the wheel speed is too low. On a machine turning 1800 rpm the wheel diameter should be 11 inches. The usual six- or seven-inch wheels should turn at 3000 rpm.

Many polishers also insist that rouge should be dipped in kerosene before charging the wheel. This supposedly promotes the penetration of the rouge into the wheel

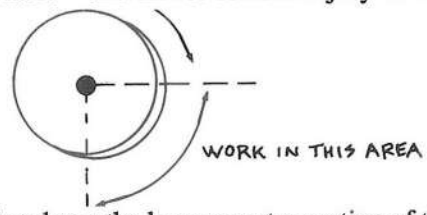
fibers so less is blown away during the polishing process. Perhaps so...for someone who believes the stench and flammability of kerosene equates with a few lost particles of rouge.

To keep the desired sharp metal angles when machine buffing and polishing many setters resort to the sharp or knife edged hard felt or wood wheels. These wheels are available in a variety of sizes and shapes. They represent an outstanding opportunity to maintain the sharpness of angles and edges while still applying a beautiful finish to the metal.

When used extensively wood or felt wheels become dull and sharpening is a must. Some fine sandpaper glued to a flat stick will suffice to keep your wood wheels sharpened. As for the hard felt wheel, try using the edge of a file or a hacksaw blade...both of which can be used on wood wheels, too. Avoid, though, cutting grooves into the wheels.

Use Care When Machine Polishing...

Although a jeweler's polishing lathe can be a true time saver it represents considerable danger to the uninitiated. A fast turning polishing wheel can snatch a piece of jewelry out of a polisher's hand—and inflict serious injury to the hands while doing it.



To minimize wheel accidents, work only on the lower quarter portion of the wheel. Snatching incidents generally occur when you inadvertently move up on the wheel. Also, wear safety glasses. When a wheel snags a piece of jewelry it can hurl it with considerable force.

Small leather finger guards are available commercially. These should be worn for the protection—clumsy as they feel—of your fingers. They also help keep your fingers clean. Leather gloves are even better. They may complicate the handling of small items, but after you've paid a visit to the doctor for finger repairs from a snatched ring laceration you might willingly introduce some protective complications into your polishing life.

If you insist on working with your bare hands, use a pinch (breakaway) grip. You certainly don't want to entwine your fingers into the work. Pause a moment before going to the wheel with an unusual grip: if the article is snatched will it pop away from your hands free?

Gloves provide an additional advantage. They prevent fingerprints that can cause rouge dust to cake on the metal surface. With a flexshaft, of course, the dangers are considerably less and working with your bare hands is standard practice. You'll find that holding the work in a cleaning tissue removes the fingerprint problem—and you can use the tissue to wipe away residue when making progress checks.

With a lathe keep long hair tied back and avoid wearing neckties, loose flappy clothing or any dangling articles. Keep your shirt sleeves buttoned or rolled up high. The dust collector blower creates a downdraft that can sometimes suck in loose clothing. Chains are the most dangerous, cut inflicting items of all—even when you're polishing them.

The principle to keep always in mind about a jeweler's polishing lathe is this: *it is a powerful, fast revolving accident looking for a chance to occur.* Discipline yourself into using an appropriate safety procedure and stick to it.

Techniques in Electrofinishing...

Few techniques are more capable than electroplating for enhancing a brilliant, even finish on metal. By means of a direct electrical current, finishes as thin as 1 millionth of an inch of gold, rhodium, silver, copper and nickel can be plated onto jewelry objects.

In most applications, the process is purely cosmetic, unable to hide scratches, dents and surface deformations. Any deficiency in the original finish will show right through the plate. Given a fine, smooth, professional polish, though, it's extraordinary how a thin plating will contribute to the rich mirror finish that is so desired. This explains why electrofinishing has become standard policy in many manufacturing and repair shops where the work is not considered complete until a flash coat of 24K yellow gold or rhodium has been electrically deposited on each polished piece of metal work...sort of like putting the icing on the cake.

The flash plating will wear off rather quickly, of course but the dramatic improvement in over-all appearance of even a well-done piece of work can sometimes be breathtaking.

Although gold flash and color plating is mostly used in the costume jewelry business, yellow gold plating also finds high employment among fine jewelry makers.

Another plating metal used extensively with white gold and platinum is rhodium. Durable, hard, and the whitest of all metals in the platinum family, rhodium will not tarnish and is unaffected by perspiration and acids. It's brilliant whiteness also makes it ideal for creating two-tone effects as well as plating the metal around diamond settings.

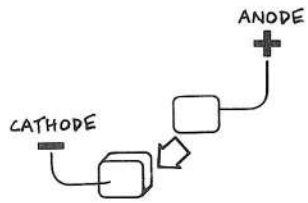
Indeed, when many laymen express a fondness for platinum and white gold jewelry they may be inadvertently referring to the rhodium finish. Platinum isn't all that brilliantly white in its natural color and the oxidation of alloys in white gold tend to remove the benefit of standard polishing rather soon.

Silver, which features extreme throwing power, is plated onto brass, copper, and white metal costume jewelry.

Copper finds most uses as a conductive undercoating and for electro-forming. Electro-forming is a build-up electrolytic process whereby thick deposits of metal are plated onto non-conductive materials such as paper, wax, Styrofoam to produce form objects.

Nickel is finish plated onto brass, silver, and also serves as an undercoating for white metal, silver and platinum. The latter are relatively porous metals so the nickel is used as a seal before the final rhodium or gold finish is applied.

The theory of electrolysis is quite simple. A direct electric current moving from the positive pole to the negative pole is passed through a solution containing compounds of the metal.



BECAUSE CURRENT RUNS FROM POSITIVE TO NEGATIVE THE METAL WILL LEAVE THE ANODE AND BE DEPOSITED ON THE CATHODE.

The current enters the solution—called the electrolyte—at the anode (+) and leaves as the cathode (-) terminal. This passage of current is called electrolysis. Oxygen is released at the anode, and metal from the solution is deposited at the cathode. Since the object to be plated is suspended by a current-carrying copper wire from the cathode, it receives the metal deposit ie., it is plated.

If the process is reversed, that is the object is suspended from the anode, metal will be removed from the object: it will be stripped. Stripping leaves the metal bright so the process is often used to reduce the amount of polishing needed.

A few words of extreme caution are in order before proceeding: the solutions utilized in electrofinishing involve cyanide or acids. Cyanide is a deadly poison and should be kept out of the reach of children—and out of contact with any kind of acid. When cyanide comes in contact with acid lethal cyanic gas is released.

Because of the growing popularity of acid-based commercial plating materials the acid-and-cyanide danger increases. The biggest danger involves electro-cleaners, almost all of which are cyanide based. In a plating operation, it's customary to electro clean the object, rinse it in water, and then plate.

The danger element becomes obvious when the two antagonistic agents—a cyanide-based cleaner followed by an acid-based plating solution—are used in such a sequence...or even if the two are on the same bench together. It's a danger not worth running. Separate operations—with a time element separating the two—might be the wisest course if you plan to use an acid-based plating solution following electro cleaning.

Electroplating Not Expensive...

Setting up a plating system need not be expensive, nor does it require a lot of space. Furthermore, some of the specialty plating tools can easily be hand made.

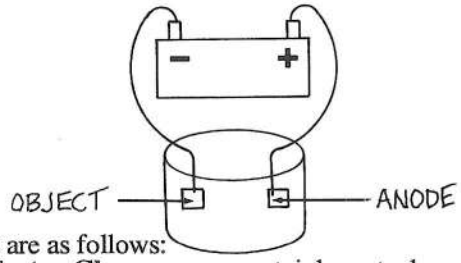
Although the cost of small, economical rectifiers is well within the reach of even the most budget conscious person, an inexpensive 6-volt drycell battery and two sections of 16 or 18 gauge copper wire will provide an effective substitute.

You'll need a hotplate, either gas or electric, because some of the solutions must be heated. Place a metal screen or plate over the burners to avoid direct contact with the screw top 800 cc Pyrex jars. Commercial stainless steel pots may be placed directly on the burners, but these pots are difficult to seal when not in use—and their opacity makes it near impossible to see what you're doing. Pyrex chemical type beakers also present the problem of not sealing airtight when not in use.

Depending on how much workshop space you have available, you can provide for a complete three-step set up with copper bars. Gold and rhodium solutions require heat and 6 volts. Place the electro cleaner to the left, the distilled rinse container in

the middle, and the appropriate metal solution on the right.

Connect the copper bars to the rectifier or battery and then use copper wire to suspend the anodes from the bar into the solutions.



Anodes are as follows:

For **Electro Cleaner**—use a stainless steel anode

For **Gold Plating**—use a 24K gold anode, or stainless steel (a gold anode replenishes the electrolyte's gold supply: the solution becomes exhausted with a steel anode).

For **Rhodium Plating**—use a platinum anode (with commercial anodes be very careful that only the platinum is submerged in the solution. The components of these platinum anodes are held together by a steel rivet and the rivet—or any other metal—will contaminate the rhodium solution upon contact).

The required plating voltages are 2-6 volts for gold and 3-5 volts for rhodium. Both plating solutions are usually heated to about 160° for best results, but read the manufacturer's recommendations for any solutions you use.

As for amperage, this depends on the surface area to be plated. With 1.5 to 3 amps, the average gold object, constantly being turned so that all surfaces are exposed to the anode, should remain in the solution about 30 seconds.

With Rhodium, "Flash Plate" is Best...

Rhodium is generally "flash plated" so the procedure is slightly different from gold plating. Immerse and agitate the object in the heated rhodium solution for only five seconds, then remove and rinse. Rhodium tends to reach its brightest within five seconds. Leaving the object in the solution any longer leads to overplating which often produces spots or turns the plate gray. If the first try at a rhodium finish fails, apply a nickel plate over the existing plate and repeat the procedure. Once you get rhodium on you won't be able to remove it ...it's truly tough.

You'll quickly learn that most of the problems in plating arise from a metal

surface that has been insufficiently cleaned or prepared...or the chemicals have been contaminated.

Procedure For Electrofinishing...

Here is the procedure for electrofinishing:

1. POLISH

Polish the object to produce the highest possible luster (again, electrofinishing is merely a thin covering, and will not hide or mask any polishing deficiency).

2. CLEAN

Attach the article to a length of 16 or 18 gauge wire (don't touch the article with your hands for the remainder of the operation) and boil it in a solution of detergent and water with a bit of baking soda and ammonia.

Option: If boiling is too dangerous for the stone, brush the article clean in the same solution at a lukewarm temperture, or immerse it in an ultra sonic cleaner.

3. ELECTRO-CLEAN

Attach the copper wire to the negative terminal of the battery or rectifier and—at 6-8 volts—drop the object in the heated electro cleaner solution. Leave it in the cleaner for 15-30 seconds. You'll easily see hydrogen bubbles form on the object's surface and these bubbles not only agitate the solution and promote soap action in the cleaner but carry away grease and dirt from the work's surface.

4. RINSE

Remove the object from the electro cleaner and rinse thoroughly in distilled water. Running tap water can also be used.

5. PLATE

Attach the object again to the cathode or negative pole and immerse in the heated plating solution. If you're plating gold, agitate the workpiece for 30-60 seconds; if it's rhodium agitate for about 5 seconds.

6. RINSE DRY

Rinse in running tap water. Dry in sawdust or use a hair dry blower.

Spot and Two-Tone Plating...

Two-tone gold jewelry—the mating of white and yellow gold in the same

article—has remained popular ever since its introduction by Queen Elizabeth of England.

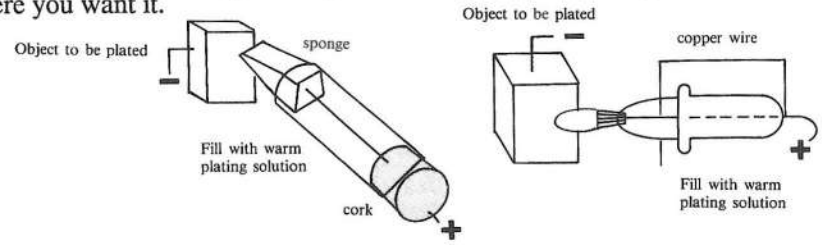
With the introduction of improved electrolytic processes in the jewelry trades, two-tone finishes have become as easy to achieve as painting...and that's actually how the effect can be produced.

Stop-off lacquer—or ordinary fingernail polish—is painted on the item where you want no plating action. Once the lacquer is in place, the desired finish, gold for yellow and rhodium for white, is plated on the uncovered area. The article is dipped in alcohol and the lacquer is wiped off. It's that easy.

You Can Make a Plating "Brush"...

An easier, quicker technique for spot or two-tone plating is achieved with a plating "brush." You can make one yourself from a glass cylinder that is open on both ends. Stop up one end of the glass tube with a cork through which you have passed a section of 16 or 18 gauge copper wire that extends well into the tube. Fill the glass tube with warm electrolyte and stop up the other end with a section of sponge. You can shape the sponge working tip to a more manageable size. To assure the flow of current, you can also run the copper wire from the cork, through the tube, and into the sponge painting tip.

With copper wire, connect the object to the negative pole on the battery/rectifier, and the plating brush to the positive pole. Now just "paint" the gold or rhodium finish where you want it.



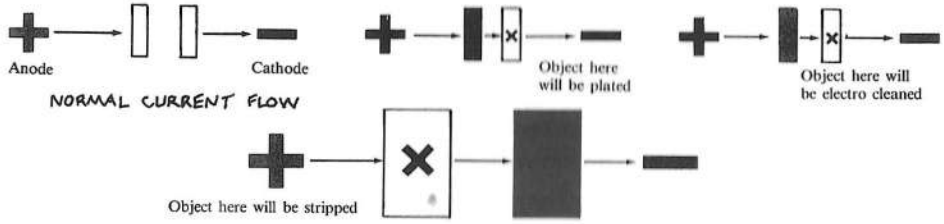
A similar brush, useful for working in much tighter corners or crevices, can be made from the standard medicine dropper. Feed a length of 16 or 18 gauge copper wire through the rubber bulb and then through the glass dropper. Wrap copper around the quills taken from a small artist's brush and stuff this brush tip into the small dropper opening.

Fill the bulb with warm electrolyte and reassemble the dropper. Push the copper wire until it contacts the brush quills—so the brush becomes the anode (+). Connect the article to the negative pole, the brush wire to the positive pole and squeeze—a drop at a time—the plating solution onto the workpiece. In true painter's fashion, you can also dip the brush tip into a reservoir of electrolyte as you proceed with your "paint plating."

Procedure for "Stripping" Metal...

Stripping is an electrolytic process that will come in handy whenever you face the need to remove metal. This can be an especially useful aid when you wish to eliminate oxidation from a surface metal so it will appear bright or to reduce the upcoming polishing task.

It is a highly effective technique for removing old plating and for getting into places where brushes and files simply won't reach.



The procedure for stripping is the reverse of plating. That is, the article to be stripped becomes the anode (+), and a piece of brass or stainless steel becomes the cathode (-). Commercial stripping solutions, all of which are cyanide based, are available at a modest cost.

The solution works best when heated to the manufacturer's specifications and 6-8 volts are applied. It is not at all unusual for the workpiece to turn black during the removal process. Occasionally a voltage change will remove this evidence of electrolytic action, but mostly you'll need to alternate between brass-bristled scratch brush treatments and the stripping treatment until you achieve the finish you want. Use soap as a lubricant for scratch brushing.

Gilding is Quick, Easy...

A quicker, easier technique then electro-plating for applying a lustrous finish on precious metals is known as gilding. An old—but highly reliable—method, it's as simple as dipping which is precisely what is done.

To make a shop supply of the dipping solution, add one pint of gold chloride to

two pints of distilled water. Then add 16 ounces of potassium bicarbonate. The mixture is heated for one hour without coming to a boil.

The completely clean article is immersed in the warm solution—using a 16 or 18 gauge copper wire—until the desired color is reached. Gilding produces a quick, uniform coating of the desired color almost without fail. It's a marvelous tactic to gild a repair job when you've finished the gold work because the finish is stunning—albeit not especially permanent.

To make chloride of gold, dissolve six pennyweights of gold in one pint of an acid mixture. The latter consists of equal parts of muriatic acid and nitric acid.

Always mix acids in a glass or Pyrex containers. Pour acids slowly, wear gloves, and keep a plentiful supply of water handy to flush away any acid that comes in contact with your skin. Obviously, rubber gloves and safety glasses are a must when working with acid. It's also a good idea to have a description of the acids handy to provide a doctor who may need that information as part of any emergency situation.

Some Stones Are Sensitive...

As a final reminder for this chapter, keep in mind that not all gemstones can be plated in these heated chemical solutions, some of which are acid based. This certainly holds true of all porous stones as well as most of the organic gems.

Still, though, a number of gemstones that are normally sensitive to acids could be subjected to electrolytic processes without undue dangers. The time in the chemicals is short and if the gems are not subjected to rapid temperature shocks and are rinsed promptly the uses of electrical processes can be utilized.

In any event, the plating brushes while slower do an adequate job and they don't subject the stone to serious dangers. You'll need only to modify the cleaning steps and this must be done regardless.

ACKNOWLEDGEMENTS

Dictionary of Gems and Gemology, by Robert M. Shipley Gemological Institute of America, Santa Monica, CA
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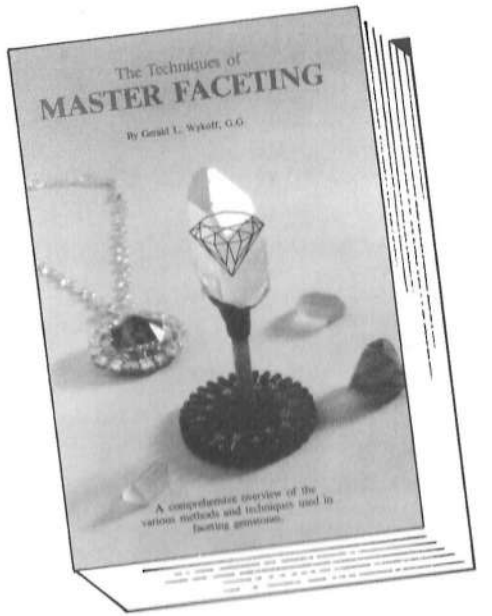
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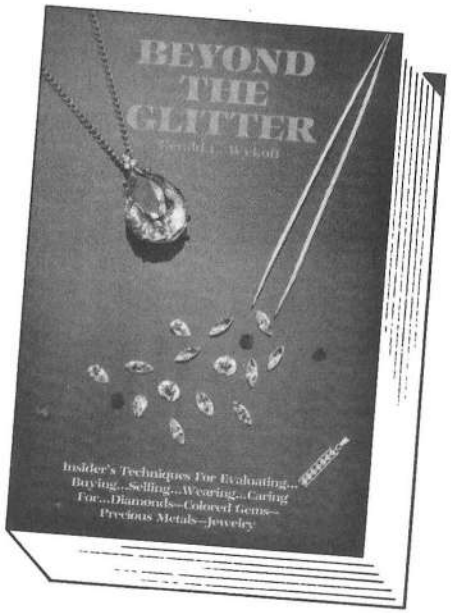

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